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ent causes of variation, but really it is not important to know how much each of these may be in any particular case. We may assume that where the variation has two or three hundredths of an inch it has been in a nearly uniform direction, though it may have been a combination of several of these causes. Checking of the record may also be obtained by reading bench marks provided beforehand either at some point fixed by the survey or determined by railroads. Another easy means of checking, if near a large stream, is by taking readings at the surface of the water. A large stream is virtually horizontal; the slope of the Missouri river, for example, is less than a foot a mile. Of course a lake would be exactly horizontal.

#### CONCLUSIONS.

1. If these rules are carefully followed you may count on determining the difference in altitude between two points to be within 10 feet of correct; even to 5 feet if conditions are favorable.
2. By this means one can determine a slope of from 5 to 10 feet per mile.
3. The accuracy may be increased by the use of an automobile, which enables one to make readings at different points in very short time.
4. The aneroid is of special service, if not indispensable, in rough and timbered areas where few stations are in sight of one another.
5. It is particularly helpful in working out disturbed strata rapidly, and therefore most convenient for rapid reconnaissance of oil structures.

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### **Archæological Notes on Pine River Valley, Colorado, and the Kayenta-Tuba Region, Arizona.**

ALBERT B. REAGAN.

The work on these areas covers the period from 1916 to 1920, as time would permit. For convenience, each region—Pine river, Kayenta, and Tuba—and the notes on same will be considered separately.

#### **THE ANCIENT RUINS IN LOWER AND MIDDLE PINE RIVER VALLEY, COLORADO.**

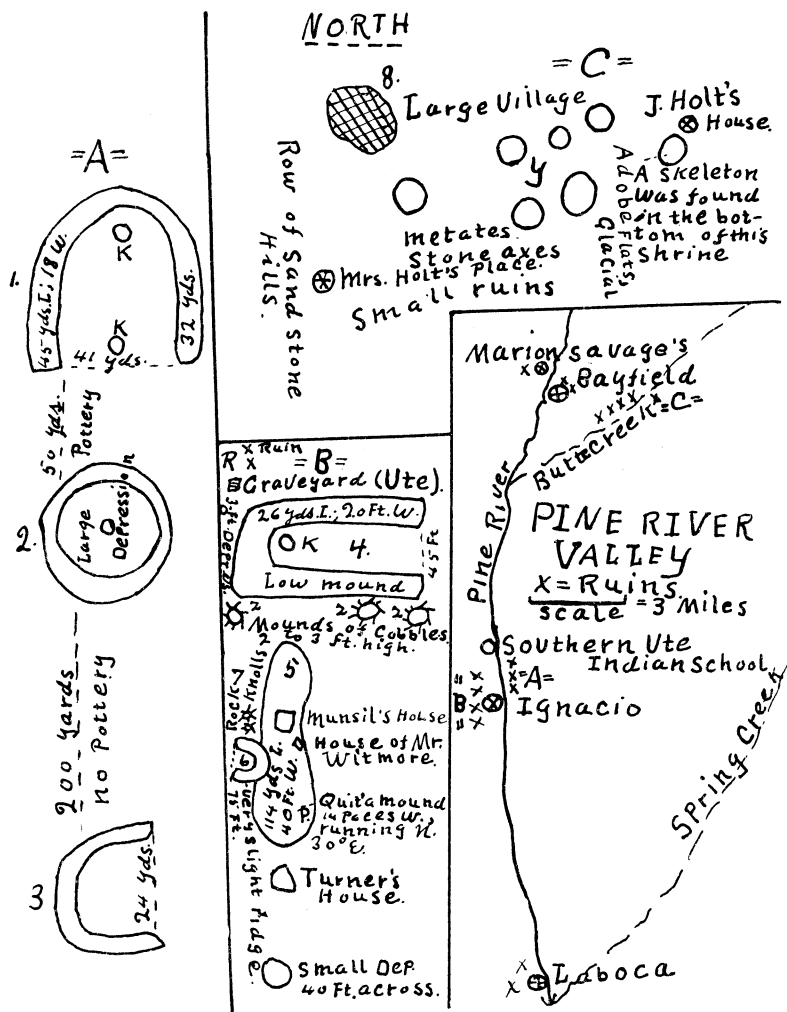
Pine river, a tributary of the San Juan, runs nearly north and south from about the south line of Colorado northward to the top of the San Juan range, at about a third the distance from Durango to Pagosa Springs. The stream is of rapid current and carries a large volume of water, enough to irrigate a much larger area than is now irrigated by it. The lower and middle inner valley, which is elevated but little above the stream, is usually not over half a mile wide. The first bench encircling this varies in width from a quarter to a half mile, and in elevation from twenty to forty feet. Surrounding this bench is the mesa country, which rises some sixty feet above the first bench and extends back on each side of the river to the mesa-mountains as a table-land country, the width varying greatly. The inner valley and first bench are composed of silt and cobbles. The mesa is adobe overlying cobblestones of the Durango glacial stage and occasional country rock, with knobs of country rock jutting above the plain here and there. Originally, large sagebrush covered the whole region, among which were scattered cedars and piñons.

To-day fine irrigated farms cover considerable of the area, and along the stream are the thriving towns of Bayfield, La Boca and Ignacio. The region for many years has been the home of the Southern Ute Indians, and the Southern Ute boarding school and agency are now situated at Ignacio. Much of the region is now settled by white people. The principal crops raised are alfalfa, wheat, oats, barley, potatoes, garden truck and fruit. One year, when the writer had charge of the Indian school there, 400 bushels of potatoes were raised on a single acre of the school land, and 19 acres of meadow produced over 100 tons of alfalfa. The elevation is about 6,500 feet. The climate is mild. There is snow in winter, and in summer 90 degrees of heat is seldom reached. From mid-July to the close of September it showers nearly every afternoon. The climate is healthful.

This region has never been touched in an archæological way. In the long past this region was inhabited by a race of tillers of the soil and builders of villages, as is attested by the scattered ruins on the edge of the mesa on both sides of the river and also in the Butte creek region east of Bayfield. In many respects the ruins resemble those of the "Small-house People" of northern New Mexico, previously described in *El Palacio* (W. B. Douglas, in April and July numbers, 1917), but differ from those in that at least in several instances the buildings were made of poles, stood apparently in upright position, and adobe mortar plastered on both sides of these to make the walls. In several other instances a form seems to have been made of poles and the adobe poured into it and let dry. The ruins of Keetseel and Betatakin, in the Kayenta section, also have walls still standing in a good state of preservation, made by each of these systems. The solid adobe walls were all made by the puddling process. The roofs were made of cedar poles, over which brush and probably rushes were placed, and on top of this mud was placed. Many of the ruins were destroyed by fire, as is attested by the adobe being burned to a brick consistency.

There are many ruins in the region, but as time would not permit, only a few near the school were visited by the writer. These were the ruins near La Boca; at Bayfield; at Mr. Marion Savage's place, west of Pine river, two miles west of north of Bayfield; at Butte creek, on the mesa east of Pine river, one mile southeast of the Southern Ute boarding school; and a string of villages west and northwest of Ignacio. The ruins at La Boca and in the vicinity of Bayfield were not examined, and the rest were examined only superficially. Below is a description of the ruins examined.

*Ruins on the mesa across the river, east of the Indian school* (marked "A" on the plate). The ruins here lie in a north-and-south direction, just back of the west front of the mesa, east of the Southern Ute agency and school. There are three major ruins (numbered 1, 2 and 3 on the plate), and some scant remains of what appears to be detached houses. The villages seem to have been placed on the edge of the mesa, which is slightly ridged here, so as to be close to the fertile valley lands of the river adjacent, and also to be able to overlook both the valley and the mesa eastward from them, as a matter of protection from enemies. From the evidence, the ridge was inhabited throughout probably hundreds of years, and it is now hundreds of years since the simple-hearted folk left their happy homes to the wearing away of the elements. To-day not one foot of wall appears to be in place; only tumbled heaps remain, and from appearances even much of these has been leached



Pine river valley and ruins, Colorado.

out and carried to the valleys by the dashing rains, melting snows and whirling winds of the coming and going years. Around the ruins, especially that of village number 1, there are numerous pottery fragments and pieces of chipped flint scattered here and there; and in the case of the village cited, they blanket the hillside and extend quite a distance toward the village from it. Arrowheads, stone axes and grinding slabs are also present in considerable numbers. Sagebrush, cedars and piñons overtop these ruins now.

No. 1 is the ruin of a very old village, as has been suggested. It was also occupied for a long period of time, as is attested by the great quantity of broken pottery scattered hundreds of feet on each side of it and extending

from it down the hill slope to the westward, as has been stated. The village is in horseshoe shape, with an original width of probably fifty feet. Its plaza opened to the south. Within it are two circular depressions (figure K), which were probably kivas (*estufas*). The village debris is now three feet thick. The places seem to have been sacked and destroyed by an enemy, as the room mortar was burned into brick.

No. 2 is the ruin of what appears to have been a circular village, from which no openings can now be discerned. It also evidently had a high wall, as is attested by the bulky mass of debris. A large, deep, circular depression occupies its center, and was probably a kiva. From the more scanty pottery remains, it was evidently not occupied so long as ruin No. 1, though at one time it might have been continuous with it, as the pottery shards are continuous. It was also likely a much later village, as its mound seems to be better preserved; it appears not to have suffered so much from the ravages of time.

No. 3 is a ruin some 200 feet south of No. 2. It is built in horseshoe shape, facing the east. Its widest space between house walls appears to have been more than twenty feet. The mound is now low and hardly traceable. There is much pottery scattered about the place. From appearance, it is as old as village No. 1, or older. It has suffered from the ravages of time till it is almost obliterated. It is easy to conclude that many revolving centuries have passed since fate drove the industrious workers from this home or allowed them to perish in it.

*The ruins on the mesa west of Ignacio* (marked "B" on the plate). On the east edge of the mesa immediately west of Ignacio is a series of ruins extending in a north-and-south direction for probably half a mile. They are extensive and for the most part are apparently practically continuous, with outlying villages extending to the northwestward. On account of the area being under cultivation these ruins are much disturbed, and in most cases the original position of the debris cannot now be determined. Moreover, after the Utes were moved to this region by the government they also made this ridge their village site till they were persuaded to take lands in severalty, they also making their graveyard on the ancient ruins. Consequently, in the present disturbed condition it is hard to tell exactly what is Ute and what ancient debris. The ruins that can be traced, however, are of the Pueblo type, and the fragments of pottery and the buried grinding slabs evidently belonged to that race. The Ute rubbish was evidently only a veneer to the ancient debris before the same was heterogeneously mixed by the white man's tilling the soil.

The people who occupied these ruins evidently occupied them for a long period of time, as is indicated by the broken pottery and by the worn metates. The rubbing of hand pieces (*manos*) less in size than the grinding slabs have worn deep grooves, often six to ten inches deep, in the hardest kind of rock. The large size of these slabs also indicates that they must have been permanently placed in some sort of a frame as are the grinding slabs of our Pueblo houses at the present day. They were evidently too large to be used by a wandering people. Notwithstanding the evident antiquity of the basic ruins, the living of the "Small-house People" there is apparently later than that of the peoples who occupied the site across the river from the Indian

school, as there is a greater bulk of debris and less pottery. Moreover, as in the case of the former ruins, there is evidence that at least a part of these ruins were destroyed by fire, and likely in an attack.

As previously suggested, the main ruin begins at the Ute graveyard and extends along the mesa front for a distance of about a half mile to about forty feet north of Mr. Turner's house. South of his house there are also indications of there having been detached houses here and there in the long-distant past. Throughout the whole distance there is an almost uninterrupted continuation of village mounds, pieces of pottery, brick-burned clay slag, grinding slabs, hand pieces (*manos*), chipped flint fragments, arrowheads, etc. The figures covering this area are 4, 5, 6, and 7, with accompanying lettered objects.

No. 4 is the outline of a ruin in elongated horseshoe shape, just north of Mr. Munsil's house. It is open to the west and extends eastward to the very edge of the mesa. Its north limb is now low. Within it is a shallow circular depression (figure K), which was likely a kiva. Just south of it are three small cobblestone mounds (figure Z), which are likely the remains of ovens.

Just north of this ruin (No. 4) is the Ute graveyard, which shows the former Ute mode of burying the dead as was practiced by them soon after they were transferred to the region. Farther on to the northwestward are the small ruins (figures R). Each is very small in size, but seems to show the horseshoe-shape type. Each is a tumbled mass grown over with dense sagebrush, among which are scattered fragments of pottery of the Small-house village Indian type.

The pottery found here, as at the other ruins examined, was very thin, and for the most part had been pressed in shape with the hand, or likely a gourd rind, as the Jemez women make pottery to-day, though the pottery was of a much better quality than that of the Jemez of the present time. A few pieces of pottery found, however, showed that the mud had been pressed into a woven basket or woven form—in a case or two, over the form—and dried. Then the form was removed in the pot-burning process. Some also were thumb-marked or corrugated ware. The pottery varied in size from small urns, probably used in religious ceremonies, to jugs with handles or knobs for carrying, and large trays, which were probably soup containers. The ears of some of the eared pots were also perforated for the fastening of carrying straps. Most of the pottery was painted an ashen color and was further decorated in black and red designs, among which were raindrops, clouds, snakes, the swastika of the four winds, the sun, moon and stars (the latter are simple crosses), the thunder bird, and the steps to the happy hunting ground.

No. 5 is a continuous ridge of debris ranging from two to four feet in thickness, probably the remains of a succession of villages, now jumbled together in a plowed field. On the east side, facing the edge of the mesa and valley, are the distinct remains of a small horseshoe-shaped village (figure 6). It would seem that this village is more recent in time than the other villages of this ridge, as it is superimposed on the debris of former villages. Above this village are two round knolls (figure 7), which probably are the remains of ovens. In addition, in the northeast part of the main village area is a mound (figure P) fourteen paces wide, which was probably a watchtower, though this is simply conjecture. Then some distance south of Mr. Turner's house is a

small circular depression forty feet in diameter and of considerable depth. Near it also is a circle of cobblestones some ten feet in diameter (almost like shrine No. 24 of the Small-house People, described by Mr. Douglas in *El Palacio*, July, 1917, p. 21). These are probably the remains of a kiva and an open altar (shrine).

As stated, the site of these ruins has been used as farm land, and is now being laid off in town lots. Houses are being built on the old ruins and considerable excavation done. In this work many valuable curios have been unearthed. Most of these so far obtained were found in excavating a cave on Mr. J. C. Whitmore's place and in a garden south of the Whitmore house. Among these were an earthen duck about normal size, crude pottery intact, several large jars, several jugs, vases, some shallowlike dishes, almost a perfect goose, ordinary pottery, a stone pipe (cloud blower), several human skeletons, several metates and manos, several pestles, and a mystic snake bowl. The latter is of special interest. It was about six inches through and nine or ten inches high. It had serpents drawn around its bottom and bulged part. It also had a hollow bottom, so that the hollow would fit over a marble. Undoubtedly it was made to fit over a point of some kind similarly, and was made to whirl round while placed on this point. Placing the jar on a marble and whirling it round and round, the snakes were so placed on it that they appeared to be running and dodging past each other on the surface of the jar. It is too bad that this valuable collection has passed into private hands and been lost to the scientific world.

*The ruins at the head of Butte creek* (marked "C" on the plate). Butte creek, a tributary of Pine river, heads in the hill country east of Bayfield. Its upper middle course runs through a level basin area surrounded on all sides by hills of residual rocks. In this area there are abundant remains of a former civilization of a people of the Small-house type. The whole area is fertile and no doubt was farmed by this people in those far-off times, using the water of the stream for irrigating purposes. The ruins are numerous, but only one reaches the village size. At places here and there over the flat area are the remains of what was probably a single house of the puddled adobe type; also scattered here and there over the area are pestles, metates, manos, Indian axes, mallets, etc. Large circular depressions, often with raised borders, also occur here and there. Furthermore, instead of being perched on the edge of a mesa, as in the case of the other villages described, the main village is placed on a hill, and in addition it is composed partly of rock instead of all of adobe as the others are.

It is likely that the single lodges were summer lodges, used very much like the outlying lodges often used by the Jemez in tending and watching their crops in summer. The circular depressions, 40 to 100 feet in diameter (figure Y), seem to be too numerous and too large to have been used as kivas (without roofs) unless this flat was a ceremonial assembling place for all the inhabitants of the upper San Juan region in that distant time. The village, though large, never had people enough to necessitate that many kivas. In many respects they resemble Mr. Douglas' "depression shrine," in the article cited, pages 17, 23 and 25. It would, however, seem that they were reservoirs and were used to store water in high-water time for use in the drier part of the year. This theory is strengthened by the fact that they are in flats, where

there were undoubtedly fields in that day; none are near the main village. The village is quite large and the debris to-day is a massive pile. Two plazas and several *estufa* (kiva) depressions can be discerned. Fragmentary pottery, chipped flint, grinding slabs and other artifacts are scattered about the place. Everything indicates that a numerous population, probably over 700 souls, once inhabited the site.

## TUBA AND VICINITY, ARIZONA, WITH INCLUDED RUINS.

### INTRODUCTION.

Tuba (with the neighboring wash and village of Moenkopi) is an oasis in the western Navajo desert about half way between Flagstaff and Marsh pass, near the Utah line. It owes its existence to living springs, as does the sister places of Moenkopi (Indian village and fields of Moenkopi wash two miles distant), Moa Ave, five miles to the southwest, and Reservoir canyon, a mile and a half to the eastward.

This oasis has received but little mention, though it is the headquarters of the western Navajo agency, which controls 6,000 souls who roam over an area as large as Massachusetts and Rhode Island combined. Those who have written anything bearing directly on the region are Hough,<sup>1</sup> Lewton,<sup>2</sup> Coues (Elliot),<sup>3</sup> Joseph Little ("Hamblin"),<sup>4</sup> Gregory,<sup>5</sup> and reference relating to the whole region, as included in Mr. Gregory's "Water-supply Paper on the Navajo Country," to which the reader is referred. Mr. Gregory's three papers, "Geology of the Navajo Country," "Water-supply of the Navajo Country" and "The Oasis of Tuba, Ariz.,"<sup>6</sup> are the most important papers. Tuba is directly mentioned in both the first and second, and the third is written directly about it, as the title indicates. But in all his papers he refers to the ruins in but one paragraph, in these words: "Ruins near Tuba, at Honogee, and the mass of debris over which the present Hopi village of Moenkopi is built, indicate a very ancient occupation"—a very slight mention of the ruins.

For convenience and to give the reader a better understanding of the region, the following subjects will be considered in the order given: Geology; soil and water supply; climate; fauna and flora; and habitation of man.

### GEOLOGY, SOIL AND WATER SUPPLY.

**GEOLOGY.** Tuba is perched on the Kaibito plateau, overlooking Moenkopi canyon wash and the Painted Desert to the southward and the escarpment formed by the tilted rocks of Echo cliffs to the westward. To the east is Reservoir canyon and to the northward the interminable sand dunes and clumps of sage extend farther than the eye can reach. The area itself is a jumble of sand dunes and jutting rocks, with a few scantily watered, fertile patches. The irrigated land at Tuba proper does not exceed 40 acres; and

<sup>1</sup> Hough, Walter; The Hopi in relation to their plant environment: American Anthropologist, X (1897), 33, 34.

<sup>2</sup> Lewton; The cotton of the Hopi Indians: Smithsonian Misc. Coll., LX (1912), No. 6, 1-10.

<sup>3</sup> Translation from Coues, Elliot; On the trail of a Spanish pioneer, II, 358.

<sup>4</sup> Little, Joseph (Jacob Hamblin); The Desert News, Salt Lake City; 1909.

<sup>5</sup> Gregory, H. E.; Geology of the Navajo country: Professional paper 93 of the U. S. Geological Survey (1917), pp. 1 to 161. Water-supply paper on the Navajo country: Water Supply Paper 380 of the U. S. Geological Survey (1916), pp. 1 to 219. The oasis of Tuba, Ariz.: Annals of the Association of American Geographers, vol. V, pp. 107-119; 1915.

<sup>6</sup> Loc. cit.



the waters from Reservoir canyon and Moenkopi washes combined, including the springs in the canyon walls, are capable of irrigating about 1,000 acres of land on the floor of the latter wash. There is also a small field or two in Reservoir canyon. These small patches comprise practically all the permanently farmed area in a region containing 7,000 square miles. For this reason this region has been called the Tuba oasis.

In a geological way, the following formations are represented in addition to the dunes and valley fills: Navajo sandstone, Todilito formation, Windgate sandstone, Chinle formation, and Shinarump conglomerate.

The Navajo sandstone covers the plateau area. It is composed of light-red, massive, cliff-making, cross-bedded, fine and variegated sandstone. The formation is here worn to a thin edge, so to speak, its entire thickness exceeding 500 feet farther to the northward. Immediately beneath the Navajo sandstone is a series of thin-bedded sandstone and shale, which is water bearing. The shale often contains sandy lumps and flattened calcareous mud pebbles. It is exposed only in the canyon walls, and is probably the Todilito formation. Also exposed in the canyon walls beneath the shale strata are massive, light-red to bright-red, crossbedded sandstone, which appears to be of the Wingate formation. The rock of this formation makes fine building stone and was used in making the government buildings at Tuba. The three formations belong to the La Plata group of the Jurassic series.

The Chinle formation and the Shinarump conglomerate are exposed south of Tuba. The former is composed of shales with thin sandstone and limestone conglomerates, much variegated, and contains much fossil wood. It is a most beautifully colored formation, often banded when forming bluffs and canyon walls. The colors striking the eye as one travels through the region are sienna, slate, various shades of brown and red, blue, white, black, chocolate, maroon, lilac, drab, purple, gray, pink, rose, ash gray, lavender and yellow. Truly the region deserves the name "Painted Desert." The conglomerate (Shinarump) series is composed of a gray conglomerate and sandstone, also containing much fossil wood. The Shinarump is probably 60 feet thick; the Chinle probably 400 feet. The two formations belong to the Triassic series.

The McElmo and Mancos formations are also exposed in the region.

**SOIL.** The soil of the oasis and also of Moenkopi wash is of the weathered country rock, limestone and lime-cemented sandstone, and from dust particles from volcanic calcareous and agrillaceous rocks blown over the region from the Little Colorado valley by the wind. Alkali is present and is damaging fields both in the wash and in the northeast fields at Tuba. Buried organic deposits, including roots and stalks of semidesert plants, furnish the organic constituents of the soil. Fine crops are raised in the area annually.

**WATER SUPPLY.** The Navajo sandstone forming the cap of the Kaibito plateau is a very cross-bedded sandstone, as we have seen. It also contains soft spots, which are blown out by the wind, forming potholes if a horizontal surface, or cliff spaces and caves if along vertical faces. When it rains the potholes fill with water and remain so till the water is evaporated, or it seeps through the rock to some underground outlet. And again, the shifting sand piles whole washes full, as it is now filling up Reservoir canyon, and also pockets large areas in circling dunes, covering parts of the area north of Tuba,

which, as a whole, is larger than the state of Connecticut. This ponding of the water also causes it to seep through the rocks to a lower outlet through the massive, cross-bedded, porous Navajo sandstone. Reaching the thinner-bedded sandstone and shale, it follows it. Approaching where this shale is nearly or wholly exposed, the water issues from the joints in the sandstone and from the shale exposures. This has been brought to the surface by abrasion and weathering and by exposing the water-bearing horizon by canyon cutting. Through this process many springs now come to the surface in Reservoir canyon and at and about the village of Moenkopi and at Moa Ave. Also at Tuba two sets of springs come to the surface, one northwest of the government plant and one northeast of it. The northwest springs are now covered over to furnish the water supply for the city, so I could not examine it. The northeast springs, several in number, gush forth in sand-elevating, bubbling springs. Both sets raise large volumes of water to the surface. Each set of these springs has a large dam to impound its water and hold it for the purpose of irrigation. Two reservoir dams have also been constructed in Reservoir canyon and one large dam in the Moenkopi wash for the same purpose, these also impounding the surface water that descends the washes. A careful husbanding of the water from these sources is now planned.

#### FAUNA AND FLORA.

**FAUNA.** The Tuba section is the home of snakes, rodents and lizards, mostly of the bright-tinted type. The snakes are mostly rattlers (several different species) and bull snakes. The rodents are field mice, field rats, prairie dogs and rabbits. The common rabbit and the prairie dog burrow; and the kangaroo rat, pouched rat, drumming mouse and pack rat make their nests about scattered clumps of brush and in rock crevices. The rats and prairie dogs are too numerous, but both the jack and common rabbits are scarce, having been practically all killed off with some disease a few years ago. The coyote is too plentiful and is a pest to the shepherds. Gray wolves are occasionally seen. Both red and gray foxes are now and then seen crossing some ridge in the distance. Years ago the antelope and mountain sheep and deer roamed the region, but are now extinct or driven from their haunts. Some of the other animals found in the region occasionally are skunk, white weasel (lives on prairie dogs, mice, etc.), striped cat, badger, porcupine (lives on roots, bark of trees and piñon nuts), lynx, cougar (very rare), blue fox (very rare), bear (very rare), pine squirrel (also very rare), chipmunk, gopher and mole (in the Tuba-Moenkopi meadows). The following birds visit the region or make it their home: Clark's jay, English sparrow, Stellar jay, road runner, robin, snowbirds, rock wren, humming bird, pine squawker (a bluebird, very numerous), red-topped woodpecker, brown woodpecker, western bluebird, cowbird, yellow-headed blackbird, red-winged blackbird, rice blackbird (brown grackle), raven, crow, several species of hawk, burrowing owl, sparrow hawk, buzzard, bald eagle, killdeer, jacksnipe, brown-legged plover, yellowlegs, sandpiper, blue-winged teal, dachick, canvasback, mallard, sandhill crane and meadowlark. (The waterfowl were seen about the impounded water about the dams at Tuba and in Reservoir canyon in October, 1918.) Sheep, goats, horses and cattle now graze on grass by the water holes and browse on the scanty brush.

FLORA. The flora of this region is of the arid type. Weather-beaten cottonwoods grow at Moa Ave and in the Moenkopi wash and are cultivated in groves at Tuba; also, quite a grove of scattered cedars (*Juniperus virginianus*) and junipers (*J. occidentalis*) are to be seen about four miles north of the Indian school, with a scattered cedar here and there, and once in a while a piñon (*Pinus edulis*). Goldenrods, Compositæ plants, rabbit brush and sagebrush (*Artemisia*) grow in favored locations. Yucca (*Yucca baccata* and *Y. angustifolia*) and cactus are now and then seen. Rushes and flags abound in the ponded areas. The common reed (*Phragmites communis*) is found about the northeast reservoir at the school and in Reservoir canyon. Round cactus (*Mammularia* sp.) and greasewood (*Sarcobatus*) are also to be found here and there, the latter in areas bordering semiwet places. The Maricopa lily grows profusely on the sand dune area east of Reservoir canyon. Native tobacco and the Hopi cotton (*Gossypium hopi* Lewton) also grow in the region. The latter is extensively cultivated by the natives. Clumps of the Arizona Jimson are seen in protected places. Wild flax grows toward the Little Colorado river. Also, following rains, short-lived, usually brilliantly colored flowering plants of various species spring up in favored spots, forming pleasing spots of color. The Indians are said to use 144 species of plants for food, medicine, dress and architecture or in their religious ceremonies. In their fields they cultivate about 25 species of plants, some of which they have obtained from the white man.

## CLIMATE.

The mean annual temperature at Tuba is about 52 degrees. The mean for July, the warmest month, is 77 degrees; of December, the coldest, 30.5. The highest temperature is in the neighborhood of 100 degrees; the lowest in the neighborhood of 0. The highest temperature yet recorded by the weather record at Tuba is 108 degrees and the lowest — 13. The nights are most always cool and the days warm to hot. Frost has killed vegetation as late as June and as early as September, but this is exceptional. Snow seldom lays on the ground more than a few days. There are about 250 clear days per annum, with the prevailing wind blowing almost continually from the southwest. The average precipitation ranges from 5 to 10 inches, being less than 3 inches in 1901 and exceeding 12.5 inches in 1906. May and June are dry months. July, August and September are the rainy summer months, and the winter months of most precipitation are November, December, January and March. At Kayenta, eighty miles north of Tuba, only fleecy clouds were seen three days in the month of June, 1919, and Tuba was no better favored. As April, May and June are the growing months for crops, it becomes very evident that crops can be raised only by irrigation. The climate is one of the most healthful in the United States.

## HABITATION OF MAN.

The first white people to visit this region was the expedition sent out from Moqui (Hopi) on an exploring expedition by Francisco Vasquez de Coronado in 1540. This expedition, headed by Don Garcia Lopez de Cardenes, went northwestward, most likely along the ancient Hopi trail, as their guides were Hopis. As a result of this northwestward march they discovered the Grand canyon. As the trip out had consumed twenty days and their provisions

were exhausted, they then returned, describing the canyon to Coronado on their return in the glowing terms:<sup>7</sup> "It is a great river whose banks 'extended three or four leagues into the air' and are 'broken into pinnacles higher than the tower of the cathedral of Seville.'" If Cardenes followed the Hopi trail, as it is supposed he did, he was undoubtedly at the Indian village of Moenkopi and went to the canyon a little westward from it. He and his party, at least, crossed the area covered by the Tuba map herewith. If Cardenes saw the village, as is supposed, it was too small to receive notice in his account of the expedition made to Coronado and the Spanish government.

In 1583 Antonio de Espejo and four white companions went directly west from the Moqui (Hopi) pueblo of Awatobi (Aguato) on a journey to Bill Williams fork in search of some mines which the Indians had told him about. They left Awatobi April 30. His route lay over the old Hopi route westward, then directly across the San Francisco mountain belt to Bill Williams fork. After examining the mines there he returned to Zuni by a different route some time in May. It is quite likely that the "Ojo Triste" mentioned in Luxan's account of the itinerary was one of the Moenkopi or Tuba springs.<sup>8</sup>

On Friday, November 17, 1598, Marcos Farfan de los Godos, a captain under Oñate, and eight companions set out from Moqui to discover some mines reported to be thirty leagues farther to the westward. These were the same mines Espejo had previously discovered. December 8 they returned, bringing flattering reports. Their route lay past Tuba and Moenkopi. Their itinerary states:

"Traveling on for two leagues along the mountain range, which was covered with snow (in all fourteen leagues—fifty or sixty miles—out from Moqui), they camped for the night on a slope where was found a small amount of grass for the horses. They camped without water. After they had unsaddled the horses and placed the sentinels, two of the Indians whom they were taking as guides said that they knew where there was water very near, and they wanted to go and bring some in some gourds. But the witness did not give his consent, as he feared they would flee unless accompanied by a trustworthy person, and accordingly Capt. Alonso de Quesada went with them.

"He took the Indians ahead of him, and after traveling about three arquebus shots from where we were lodged the Indians saw lights and dwellings, and signaled to the captain that they were the Jumana Indians. The captain, finding himself so near, told them to go over there, and having arrived there he found many Indians and Indian women in four or five rancherias, who surrounded them with their bows and arrows. The captain told them that he had a message for them; that he was not coming to do them harm, but instead to give them what he had. Thereupon they were reassured, and two Indian chiefs of the said rancheria came on with the captain and friendly Indians to where the witness and his companions were. The witness treated them very well, showing them marks of friendship, caressing them, giving them beads and other presents. He then sent them back to their own rancherias, telling them by signs that they should reassure the rest of the people, because they were not going to injure them but to be their friends and to find out where they secured the ore, which the witness showed them.

"Next morning the witness and his companions went to the said rancheria, which he found deserted, there being in it only the two chiefs and a woman. They received them with signs of gladness, and as a token of peace gave them pulverized ore and a great quantity of ground dates (*datil*), which is their food, and a few pieces of venison. The witness in return gave them

7. The journey of Coronado, 1540-'42; translated and edited by Parker Winship: A. S. Barnes & Co.; 1904.

8. Spanish explorations of the Southwest, p. 187.

more beads and presents, and begged them to go with him to show him where they got the ore. One of the Indian chiefs complied willingly."<sup>9</sup>

The *Ytinerario* gives the place as "Rancheria de los Gandules," which has been identified with Moenkopi (see below); but gives it on the wrong side of the San Francisco peaks. This is the first mention of these Indians having intimate contact with white men.<sup>1</sup>

Oñate also visited Tuba and Moenkopi on his journey to California from Moqui in 1604, following the route of Farfan and Espejo. He found the place inhabited, but so insignificant that he dubbed it the derisive term, "Rancheria de los Gandules."<sup>2</sup>

Many other explorers also likely visited the place without leaving a record of their trips, or their manuscripts still remain unpublished. And more recently following the stages of time, Spanish explorers, Mormon emigrants and government scientific expeditions have visited the site.

F. W. Hodge also comments on this region as follows:<sup>3</sup>

"Moenkopi ('place of the running water').—A small settlement about 40 miles northwest of Oraibi, northeast Arizona, occupied during the farming season by the Hopi. The present village, which consists of two irregular rows of one-story houses, was built over the remains of an older settlement, apparently the Rancheria de los Gandules seen by Oñate in 1604. Moenkopi is said to have been founded within the memory of some of the Mormon pioneers at the neighboring town of Tuba City, named after an old Oraibi chief. It was the headquarters of a large milling enterprise of the Mormons a number of years ago.

"Concebe: Garcés (1775-'76), quoted by Bancroft: *Arizona and New Mexico*, 137, 395; 1889. Moenkapi: Coues, *Garcés Diary*, 393; 1900. Moenkopi: Mindeleff, in *8th Rep. B. A. E.*, 14; 1891. Moqui Concave: *Ibid.* Moyencopi: Bourke, *Moquis of Arizona*, 229; 1884. Maube: *Ibid.* Muenkapi: Voth, *Trad. of the Hopi*, 22; 1905 (correct Hopi form). Munqui-concabe: Garcés (1776), *Diary*, 393; 1900. Muqui Concabe: *Ibid.*, 394-395 (Yavapai form). Rancheria de los Gandules: Oñate (1604), in *Doc. Ined.*, XVI, 276; 1871 (apparently identical)."

On account of Moenkopi-Tuba having abundant springs, for ages it apparently has been the crossroads point for the whole arid section between Moqui and the Colorado river and between the San Juan region and the San Francisco peaks and the region beyond to the southward. In the region about these two places are many village ruins, which indicate that a peaceful, agricultural people have inhabited it at times. The ruins also indicate that these villages were destroyed or abandoned as a result of the approach of more savage peoples. Moreover, that it received so scant a mention by the early explorers is due to its smallness, or to the fact that it was for the time temporarily abandoned. The settlers of the villages were undoubtedly Hopis (Moquis) formerly, as now, as the curios found in the debris and the tribal traditions of the Hopis indicate.

As formerly, this place in historic times has served as a station on routes across the plateau. Piutes, Walapai and Havasupai have utilized the Tuba route in their trading and foraging expeditions and marauding, hunting enterprises. This route was also followed by the white explorers, adventurers and

9. Spanish explorations of the Southwest, pp. 240, 241, and footnote, p. 241.

1. The *Ytinerario*, loc. cit., p. 276.

2. Loc. cit., 268-280; also *Collection de Documents Queditos (Ined.)*, XVI (1871), p. 276.

3. *Handbook of American Indians*, part 1, p. 919.

emigrants, as we have seen. As time passed the Piutes began to raid the corn-fields and homes of the Hopis there. Then came the superior Navajo, who dispossessed both Hopi and Piute. The oasis was, therefore, practically abandoned by the Hopis, and the Piutes retreated to the region of the San Juan. From about 1750 to the days of men now living, the Moenkopi fields were cultivated only as it was thought safe for the Hopi farmers to come from their homes forty miles away at the well-protected village of Oraibi to put in the crops and attend them, and then return to the home village when the crops were gathered, the Hopi women seldom visiting the place. Garcés, in 1776, found on the oasis a "half-ruined pueblo and some crops near a spring." He further stated that the people who cultivated the fields were Hopis, "they coming to cultivate them from the same Moqui pueblo (Oraibi), which is so large."<sup>4</sup>

From the traditions of the Hopis it is learned that a few of the Hopi men came and farmed on this oasis each year, some possibly staying year by year. A few Piutes and Navajos appear also to have had fields there from time to time. As late as 1874 Jacob Hamblin found "only one Piute family and one Oraibi woman there."

In the early seventies the "saints of the Mormon Church were called to settle in Arizona," and crossing at Lee Ferry, Pierce Ferry and the "Crossing of the Fathers," they made settlements, under Jacob Hamblin and others, in the Navajo-Hopi region, Mr. Hamblin having previously made seven excursions into the region between the years 1858 and 1871. The emigrants in 1873 turned back to Utah on account of disastrous experiences in the Painted Desert, leaving but one family at Moenkopi. In 1875 this family was forced to leave by the Navajos. A permanent settlement, however, was made there the following year. The "saints" first cultivated the abandoned fields of the wash. Then later the lands of Moa Ave, Tuba and Reservoir canyon were brought under cultivation, and permanent settlements were made at the first two places. Then followed years of hardship, for though the fields yielded fruit, garden truck, corn and wheat, everything else had to be brought overland from Utah to the place, or from Albuquerque, N. Mex., 370 to 450 miles. Their building material, except rock and earth, had to be hauled from the San Francisco peaks, 70 miles distant. Moreover, the area that could be irrigated was small in comparison with the population that had to depend on it for a living. In addition there was more or less trouble with the Navajos; also at times, to keep peace with the Indians, certain Navajos and Piutes were permitted to live on the oasis, which though keeping the peace, also divided the sustaining crops among that many more families.

With the coming of the Mormons, the Hopis, under Tuba (after whom the town of Tuba City gets its name), began to return to the lands of their ancestors. The Moenkopi people state that Chief Tuba went to Salt Lake City and prevailed on the Mormon Church to send the white settlers to the region so they would be protected from the Navajos and Piutes by the hand of a stronger race. From records it also appears that Tuba and his family were the only Hopis living at Moenkopi in 1880. By 1903, 100 Hopis were residing there, and now over 300 make their home at Moenkopi.

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4. Translation from Coues (Elliot), loc. cit., II, p. 358.

In 1903 the government "purchased" the Mormon settlers' rights to the lands at Moenkopi, Tuba, Moa Ave and Reservoir canyon for \$45,000, and has since made Tuba the headquarters of the western Navajo Indian agency and school, the Mormon pioneers moving to other points in the upper Little Colorado valley, and both the government and the Indians, as well as the pioneers, have profited by the change.

This accounts, in brief, for the known occupation of Moenkopi and Tuba; but the ruins show that the place was inhabited long before the coming of the Spaniards or before the time of any Indian then living. Below is a description of the ruins examined by the writer.

*Ruin of Honogee.* Across the wash northeast of the village of Moenkopi, on top of the mesa, about directly east of the day school, is the extensive ruins of Honogee, built in the form of a rude square. Parts of its walls are still standing, which indicates that it is younger in time than the other ruins of the region, as will be noted later. Moreover, the Hopis told the writer that this was the village where they made their last stand against the Navajos, and consequently was their last abandoned village. Near to it, on the side of the bluff overlooking the canyon, are also the ruins of a series of cliff houses under an overhanging wall-roof. Five rooms are still intact, with the little, almost square doors still showing. They are built of rock, cemented in with adobe. These houses, with the ruin on top of the mesa, were unquestionably built by the Hopis, and were also most likely constructed since the coming of the men of Coronado.

*No. 1.* Ruin west of north of the agency. This is the remains of a small ruin about a half a quarter of a mile west of north of the agency office. It was perched on the down slope from the bluff bench west of the Tuba grove and fields, only a short distance from the bench. The building material was all of adobe and has all been removed by erosion, so that now only fragments of pottery mark the site. The pottery is strictly of the Pueblo type. Probably no more than seventy-five people ever lived in this village. Its position is notable for its lack of defense, as an enemy on the bench could have commanded its walls.

*No. 2.* Double-toothed butte ruin. This ruin is about a mile northeast of the school, in the Castle Butte region. A considerable building has occupied the space between the "two fang roots of an inverted, double-toothed" butte. It was made of limestone, which was carried to the place from a distance of more than a mile. A few feet of the foundation wall is now still in place. The remaining stones of the wall have mostly slid down the approaching incline to the north and are now scattered about the foot of the butte. This building was probably a watchtower. There is also evidence in pottery fragments and limestone slabs that a considerable village faced the butte on the east and south. The rooms evidently were several stories high, as niches cut in the soft sandstone for shelf space and the placing of beams are as high as twenty feet from the base of the butte. Some of these shelf spaces have Indian pictographs chiseled on their walls, but some "civilized" man has spoiled them by cutting his name over them. On the west side of this same butte, eighteen feet from the ground, two cave rooms have been cut out of the soft sandstone so that they join each other like a double pocket. The front has now been

mostly broken off. The back part of each room also has a chiseled space in which the dwellers probably set their religious things. There were also chiseled spaces for beam supports. There were also glyphs on the walls of these rooms, but, as above, some one has chiseled his name across them, much disfiguring them.

*No. 3.* A ruin east of a small butte about a quarter of a mile east of No. 2 was examined. This butte has a butte less than 100 feet both to the west and to the northeast of it. A watchtower was probably on it when the village was occupied. There is some evidence that the village once completely surrounded the butte. The village was probably of adobe, as all signs of it except the great quantity of broken pottery of the Pueblo type have been removed.

The people of villages Nos. 2 and 3 evidently farmed in Reservoir canyon, which is about a mile distant to the eastward. They also likely got their water supply from that canyon. The site of these villages is a most desolate, sand-swept area. Certainly no people would have gone to such a place to make a home except for defense. For this purpose the villages were admirably situated, except that an enemy might capture their water-supply source both at Tuba and in Reservoir canyon and thus drive them from their stronghold.

*No. 4.* This is the site of a long ruin, running in an east-and-west direction along the north line of the agency fence from a point 300 yards west of the northeast corner of the government inclosure, west of the agency road, westward several hundred yards. Much of the old site is now covered with dune material. At two places, however, two plazas can be made out, and also enough to show that the village ran in an east-and-west direction. There are many pottery fragments, also a few stones are scattered about, but not enough to have been of use in constructing the walls. The pottery fragments cross to the south of the fence to a considerable distance at several places and also show to the north of the dune ridge north of the fence, which is north of much of the pottery exposures. This village was very large, containing probably 1,000 souls, provided it was all occupied at one time. How long ago it was occupied cannot be conjectured, but it was so long ago that not a part of the wall now shows in place. It was constructed in a very poor place for defense, but probably, on account of its size, its walls made it impregnable. The water supply was situated about half way between the northwest and northeast springs at Tuba and adjacent to the lands that would be irrigated from those springs by them, but it must have been a sandy, dust-swept place in which to live.

*No. 5.* In the flat about a quarter of a mile nearly west of the Tuba school and agency there is a large mound of adobe to sandy clay, at the base of which there is scattered ancient pottery fragments. This seems to indicate that the mound is probably an ancient village site.

*No. 6.* About half way between the agency and the mound mentioned in No. 5 above, a dry arroyo has removed the most of an ancient village site. Only an area of probably twenty feet in diameter of the floor of the once village home in a bend in the dry gully is now left. This is literally covered with fragments of ancient pottery, all beautifully covered with decorations. At this date the size of this once populous village can only be conjectured.



No. 7. Just over the fence east of the Presbyterian mission at Tuba, on a slight rise of ground is the remains of a ruin represented almost wholly by pottery shards. It has been a very large village, though only a small part of the original site is now bare of dune material. Judging from the abundance of broken pottery, it was either inhabited for a long time or a large number of people lived there simultaneously.

No. 8. This ruin is just below the wind-blown sand dam that forms the third reservoir in Reservoir canyon. It was built to the east of Reservoir creek, on an adobe flat abutting a Navajo sandstone bluff to the eastward. Only a remnant of the village now remains in its representative pottery shards, but it probably was an extensive village. The place was ideal. There are farm lands below in the valley and plenty of water in the adjacent springs for all uses.

No. 9. This village was below No. 8 (above), on Reservoir canyon. Its site was elevated on a stone-floored flat to the east of the canyon. The pottery pieces and the adobe remnants of the village have practically all been removed by wind and water, so that its size cannot now be conjectured.

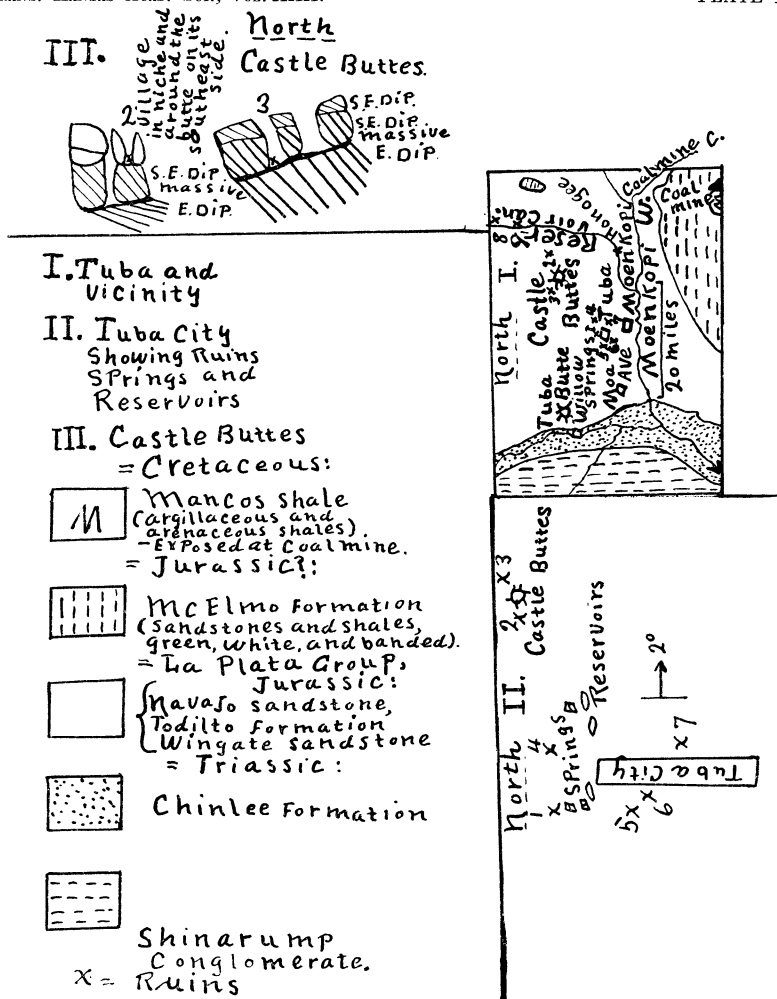
A salt cave has been worked near Moenkopi.

There are villages in the vicinity of Moa Ave and at several other places in the vicinity of Moenkopi and Tuba, but time would not permit the writer's visiting them.

From the criteria at hand, either a numerous people lived on the Tuba-Moenkopi oasis at one time, or a small population lived there many hundreds of years; and the evidence leans toward the latter. Why they abandoned the place is very evident. An ever-encroaching enemy made it unsafe to live there.

#### THE KAYENTA REGION, ARIZONA, AND ITS RUINS.

The Kayenta region, as here considered, lies between latitude  $36^{\circ} 30'$  and  $37^{\circ}$  and between longitude  $110^{\circ}$  and  $111^{\circ}$ . It is a much-dissected, canyon-cut plateau. In the main it is the region drained by upper Laguna creek and its tributaries. It comprises the region between The Monuments (mainly between Comb ridge) on the north and Black mesa on the south; Church rock on the east and the Segi mesas on the west. It is composed of a great valley of eight or nine miles in width in the vicinity of Church rock, but tapering to a point at Marsh pass, while deeply cut tributaries enter it from all sides but the east. Comb ridge, at the north, stands 500 feet above the valley floor; and Black mesa at the south, 12,000 feet; while the Segi mesas close in the western front with probably a similar elevation. The mesas to the westward are red; those to the south, due to the included shale and coal, are black. The north and west fronts are Jurassic rocks, with occasional Triassic patches. The south front is closed in by Cretaceous rocks. The road from Tuba to Kayenta from Red lake northward runs about on the contact line between the Jurassic and Cretaceous. At Marsh pass the rocks are high pitched, as are usually the rocks of Comb ridge. The rest of the rocks are of moderate dip. The dip is usually southward to southeastward. To the north of the valley are The Monuments, the headstones which for ages have been marking time in earth's giant graveyard. Also at hand are Porras dikes, Church rock, Chaistla, Slim rock and El Capitan, which act as guardians of the valley; the latter, a giant volcanic plug, stands 1,225 feet above the valley floor in which it is situated.



The Tuba-Moenkopi region and ruins, Western Navajo reservation, Arizona.

In addition, Comb ridge is composed of knobs, comb teeth, buttons and buttes. On the whole the region is surprisingly picturesque.

This beautiful region seems never to have been visited by white men till the time of people now living. No settlement was made in it till 1909. It is believed that the Spaniards visited it; but if they did, no record has been preserved, or at least published; a ruin twenty-five miles to the westward has an inscription in it, "Ghos, 1661, Ano," which shows that some Spaniard was in that section at that date, leaving this meager record. The Mormons seem to have been the first white people to go through Marsh pass. Later a government military road ran through it. In 1909 Messrs. John Wetheril

and Clyde Calville and the family of the former moved to the valley and erected the store and residence of Wetheril and Calville, naming it Kayenta (a corruption of Tyende, peculiarly uttered), after the Navajo name for a pothole in Laguna creek near by—the Indians' name meaning "bottomless hole." They then got a post office started, the mail coming by pack horse from Chin Lee, sixty miles distant. Later, then, the government established the Marsh Pass Indian boarding school twenty rods north of the Wetheril and Calville store. A missionary soon followed; then a government stockman; and still later the firm of Buckbee & Verkamp started a store at the place. The civilized population of the place now comprises about eighteen people.

When the first white men visited the region there were many pools and small lakes both in the main valley and in the canyon of the Segimesas; but about 1881 a stream, now known as Laguna creek, began to cut back from Chinle creek to the eastward. It has now not only drained all the lakes and pools, but has cut a canyon fifty feet deep through the former loose valley fillings, and now the water that once stayed in the region runs rapidly away. Reclamation work of the government is now endeavoring to erect dams in the creek to save the water for irrigation. Should the project succeed the valley will undoubtedly become one of Arizona's rich spots.

Only two subjects relating to this region have ever been touched—geology and archæology. The geology was handled by Mr. Herbert E. Gregory, of the United States Geological Survey, by whom the following papers have been published: "Geology of the Navajo Country";<sup>5</sup> "Water Supply Paper on the Navajo Country";<sup>6</sup> "The Black Mesa Coal Field of Arizona";<sup>7</sup> and "Garnet Deposits in the Navajo Reservation in Arizona and Utah."<sup>8</sup> Several parties have done archæological work in this region, principal of whom were the Wetherils, John and Richard, the Hyde Exploring Expedition; Prof. Byron Cummings, and the exploring expedition under Messrs. Alfred Vincent Kidder and Samuel J. Guernsey. The archæological works bearing directly on the region so far published are: "Preliminary Report on a Visit to the Navajo National Monument"<sup>9</sup> (ruins in Segi canyons); "The Ancient Inhabitants of the San Juan Valley";<sup>1</sup> and Cummings, 1910, "The Kivas of the San Juan Drainage";<sup>2</sup> "The Prehistoric Ruins of the San Juan Watershed in Utah, Arizona, Colorado and New Mexico";<sup>3</sup> "The Sandal Stone";<sup>4</sup> and "Archæological Explorations in Northeastern Arizona."<sup>5</sup> For a complete bibliography

5. Gregory, H. E.; Geology of the Navajo country: U. S. Geol. Surv. Professional Paper 93, pp. 1-161; 1917.

6. Gregory, H. E.; Water resources of the Navjo country: U. S. Geol. Surv. Water Supply Paper 380; 1916.

7. Campbell, M. R., and Gregory, H. E.; The Black mesa coal field, Arizona: U. S. Geol. Surv. Bull. 431, pp. 229-238; 1911.

8. Gregory, H. E.; Garnet deposits on the Navjo reservation, Arizona and Utah: Econ. Geology, vol. 11, pp. 223-230; 1916.

9. Fewkes, Jessie Walter; Preliminary report on a visit to the Navajo National Monument, Arizona: Bulletin 50, Bureau of American Ethnology, Washington; 1911.

1. Cummings, Byron, The ancient inhabitants of the San Juan valley: Bulletin of the University of Utah, Second Archæological Number, vol. iii, No. 3, pt. 2; Salt Lake City; 1910.

2. Cummings, Byron; The kivas of the San Juan drainage: American Anthropologist, n. s., vol. xvii, pp. 272-282; Lancaster, Pa., 1915.

3. Prudden, T. Mitchell; The prehistoric ruins of the San Juan watershed in Utah, Arizona, Colorado and New Mexico: American Anthropologist, n. s., vol. v, No. 2, pp. 224-288; Lancaster, Pa., 1903.

4. Wetheril, Richard; Sandal stones: The Antiquarian, vol. 1, p. 248; Columbus, Ohio.

5. Kidder, Alfred Vincent, and Guernsey, Samuel J.; Archæological explorations in northeastern Arizona: Bulletin 65, Bureau of American Ethnology; Washington, 1919.

of publications bearing on the archæology of the Navajo country in general, the reader is referred to the last-named paper above, "Archæological Explorations in Northeastern Arizona," pages 221 to 223.

All the archæological work so far done in the region has been in the main in the examination of the larger ruins of Keetseel and Betatakin and other ruins of the Segi region and adjacent canyons. It is the purpose of this paper to give a description of the smaller ruins, which are found to be surprisingly numerous. Only a brief mention will be made of ruins previously described.

In order to give a better understanding of the region, a short sketch of the geology and natural history of the country in general will be here appended, followed by a description of the respective ruins so far as examined.

#### GEOLOGY OF THE TUBA-KAYENTA REGION.

The formations represented in the region are the Quaternary, Mesaverde, Mancos, Dakota, McElmo, Navajo sandstone, Chinle, and Shinarump conglomerate. These, with some additions, are the same as those represented in the Tuba region, previously described. Where previously given in detail, the description of the formation will be condensed to the fewest possible terms. The other formations will be given in detail.

QUATERNARY (not mapped). The Quaternary of this region, which includes the recent, is composed of two series of material—dune material and the valley fillings.

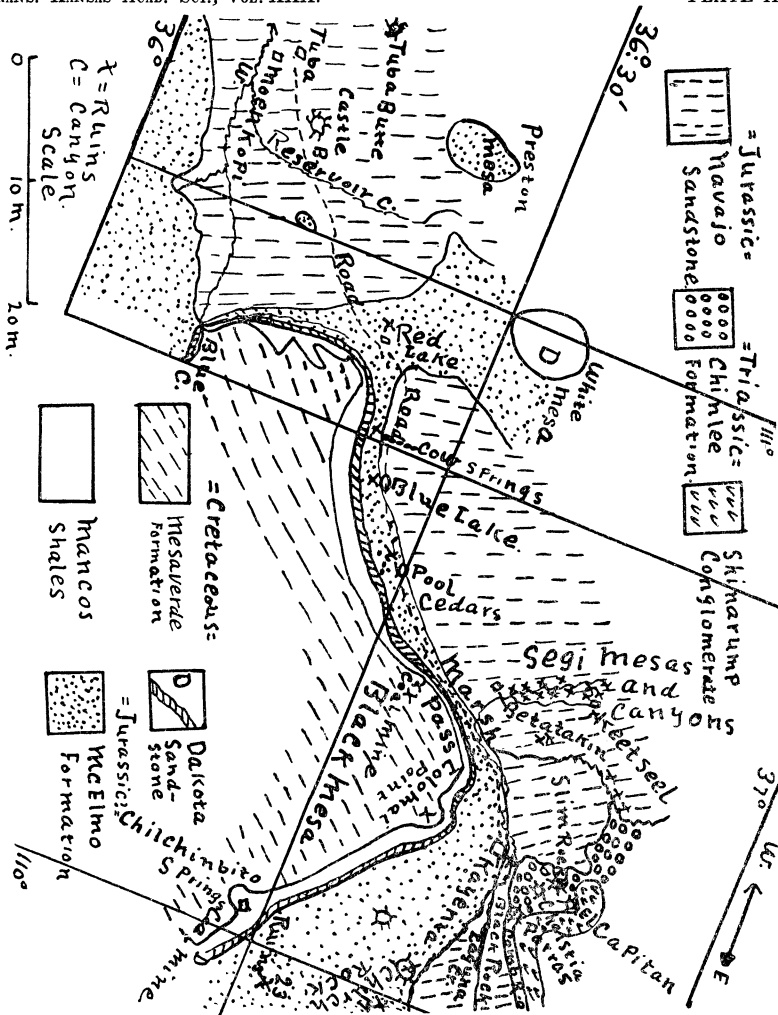
The dune material covers a great part of the country between Tuba and Red lake, and seems in a great part to be disintegrated McElmo sandstone; also in the lee of wherever the McElmo is exposed, and in the regions covered by it, there are extensive dunes. Canyons are also now being filled with this dune material, and this process has been going on for ages. Large dunes also occupy the lee of practically all the mesas and buttes on their northern and eastern sides. The prevailing wind is from the southwest and is usually high a great part of the year. At some places sand banks reach to the very tops of the buttes and mesas and form the means by which they can be scaled. Many of the flats and benches are dune swept; in fact, the whole region might be termed a sand-dune country. How long these dunes have been accumulating cannot be determined, some of the largest probably throughout Quaternary time. The recent piling of the sand has covered up many of the ancient ruins, some of which are now being uncovered by the wind. Others will probably remain totally submerged in the shifting sand for ages.

The valley fillings cover the floors of the inner valleys often to a depth exceeding fifty feet, and often fill the floor of the whole canyon space. In the flatter regions they widen out. The fillings in Laguna creek valley two miles east of the school are several miles wide. Opposite the school they are seventy-five feet in thickness. On the route from Marsh pass to Tuba, in the valley followed by the road, there are clay-adobe fillings of great depth, filling most of the whole valley. The fillings of the Laguna creek section are being rapidly cut into canyons till the country is hardly passable in places. The fillings from Marsh pass to Tuba are also being cut into by washes.

A close observation shows that a deep cutting process began in this region some time in the Tertiary and continued uninterrupted till probably in the Quaternary, when the incising process was arrested. In this denuding, all

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PLATE III.



The Tuba-Kayenta region, Arizona.

the Cretaceous, 1,000 feet or more in thickness, was wholly removed from the entire region north and west of Marsh pass and Laguna creek, also west of the Tuba-Kayenta wagon road south of the pass. The great valley of Laguna creek and the gorges of the Segi canyons were then cut, as were the cross and lateral valleys to the north of that great valley which to-day exposes the jutting teeth of Comb ridge, the volcano plugs and The Monuments. Then there set in a refilling of the valleys, which continued to our own time.

Concerning this filling of the valleys, Dutton, who with Powell examined the plateau region, 1878-1880, says:

"Most of those lateral canyons . . . are slowly filling up with alluvium at the present time, but very plainly they were much deeper at no remote epoch in the past. The lower talus in some of them is completely buried, and the alluvium mounts on the breasts of perpendicular scarps. In some cases a smooth floor of alluvium extends from side to side of what was originally a canyon valley." <sup>6</sup>

When the first white people came to the Marsh pass - Laguna creek country, there was no Laguna creek. The valley and canyon floors were a vast plain, dotted with lakes and swamps. A map made of the region in 1881 shows no stream leading out of it. Hunting parties frequented the region to kill ducks in the swamps and marshes; and the government road led through the pass over the marshy flats, hence the name "Marsh pass." Then Laguna creek began to cut back from Chinle creek thirty miles to the eastward. Year by year it extended its possessions till to-day it ramifies every part of the inner valley and the Segi canyons, has drained all the ancient pools, swamps and lakes, and has the whole country cut up with a maze of lateral, straight-walled chasms fifty feet or more in depth. And the Tokas Jay, the stream leading northward up the valley along the road toward Marsh pass from Moenkopi wash, will cut up this valley and destroy its lakes and pools, as Laguna creek has done in the Kayenta region, unless man brings about some means to stop its devastating process.

Many people, including the geologist, Herbert E. Gregory, believe that the aggrading of the valley floors of this region was due solely to climatic changes—little rainfall and the action of the wind. They also believe that the cutting of the valley fillings is due to the overgrazing of the region and the making of paths and roads. Mr. Gregory's opinion is as follows:<sup>7</sup>

"During the last twenty or thirty years, in consequence of overgrazing, and probably, too, of climatic change, the alluvial floors of canyons and washes have been trenched by streams, and the normal valley profile has been changed from a flat-floored, rock-walled gorge to a valley, including an inner canyon ten to fifty feet deep, whose walls are of alluvium. . . . This new development has resulted in enlarging the amount and increasing the permanence of stream flow. A number of perennial springs and seeps issuing from the base of the alluvium in the new-made canyons and arroyos have been added to the reservation within the last thirty years, and the amount of surface water has been increased accordingly at the expense of the ground water supply."

And again Mr. Gregory says:<sup>8</sup>

"That the streams of the region were formerly aggrading their canyon floors and that they are now trenching the valley fill are facts abundantly supported by field evidence. If the period of rock canyon cutting is termed the 'canyon cycle,' the period of aggradation and degradation may be considered, respectively, the epicycle of alluviation and the terrace epicycle. *The recency of both periods is indicated by the presence of corn cobs and pottery buried beneath terrace gravels and exposed in the banks of present streams* and by the old cottonwood trees of the upper Moenkopi valley, whose trunks, buried to depths of ten to thirty feet, have recently been excavated.

"The date of the beginning of the terrace epicycle through which the region is now passing may be fixed with a fair degree of approximation. The lake in Bonito canyon, described by Simpson<sup>9</sup> in 1850, has disappeared, and

6. Dutton, C. F.; Tertiary history of the Grand Canyon districts: U. S. Geol. Surv. Mon. 2, pp. 228, 229; 1882.

7. Water resources of the Navajo country: loc. cit., p. 100.

8. Geology of the Navajo country: loc. cit., pp. 130-132.

9. Simpson, J. H.; Journal of a military reconnaissance from Santa Fe, N. Mex., to the Navajo country (1850), p. 110.

the present arroyo is sunk twenty to thirty feet in sands and clays, including layers of peat. In Laguna canyon the lakes shown on the Marsh pass topographic map, published in 1882, are drained, and their floors are deeply trenched. According to the Navajo legend the Segi region was bewitched in 1884; the farm lands were cut out and the lakes vanished. Certain events are well authenticated. In 1880 a perennial water body existed in Tyende valley fifteen miles east of Porras dikes, and in 1893 a road traversed this valley from its mouth to Tyende, crossing and recrossing the stream at points now marked by arroyos twenty feet deep. In 1894 the flat-floored alluvial floor of Walker creek was occupied by Indian farmers and the bed of the Chinle was cultivated; in 1913 the terraces on Walker creek were eighty feet above the stream and the Chinle flowed between alluvial banks 100 feet high. Since the Mormon occupation of Tuba (City) in 1878 the Moenkopi has intrenched itself in alluvium to depths of fifteen to forty feet. The terraces on Pueblo Colorado wash at Ganado date from about 1880. At Keams canyon the deep alluvial fill is being removed so rapidly that the location of roads and buildings has become a serious problem. Accounts of prospectors, pottery hunters, government officials, Navajos and Hopis agree in placing the formation of terraces within the last twenty-five or thirty-five years. During the course of my field work in this region, in 1910 and 1909-1913, significant changes have been effected in the width and length of alluvial terraces. The floods that follow showers in July and August perform an incredible amount of erosion. It is unsafe to stand near the bank of a stream while torrents of liquid mud carrying trees and blocks of alluvium are passing.

*"Cause of terracing.* The nature of the change in physiographic environment that called a halt in the work of rock canyon cutting and introduced the epicycle of alluviation is not clearly understood. As I have shown in another connection,<sup>9</sup> a pause in regional uplift or a change to a more humid climate would permit wider distribution of gravel and better grading of streams. That the crust of the earth in northern Arizona is unstable is indicated by the recurrence of earthquakes, but no direct evidence of movement within the past few centuries has been recorded. The stream profiles are now greatly oversteepened—a condition which doubtless existed during the epicycle of alluviation. The contrary view involves the improbable assumption that the present valley gradients have resulted from differential uplift of large amount since the cliff dwellers occupied the country. A climatic rather than a tectonic cause for the epicycle of alluviation is thus suggested.

*"Change in stream habit from aggradation to degradation, introducing the terrace epicycle,* is best explained also on the hypothesis of climate fluctuation. Terracing appears to be universal over the Colorado plateaus and adjoining regions at the present time, and an uplift sufficient to produce the results accomplished in the last thirty or thirty-five years would need to have been almost continual in extent and to have been abnormally rapid. The rainfall records at Fort Wingate and at Fort Defiance show no significant cycle, either wet or dry, for the years 1880 to 1885, the period during which the vigorous down-cutting became dominant, but the rainfall in southern California for 1883-'84 was the heaviest ever recorded. Measures of fluctuation in mean annual rainfall have, however, little significance in this region. Erosion results from sudden violent showers followed by unobstructed run-off, and, if suitably distributed, in time an annual rainfall of half the normal amount may be more effective in denuding the land than a precipitation of twice the normal. Under present conditions terraces are produced by floods, the streams aggrading during periods of low water and degrading when the volume is increased—a statement, however, which implies nothing as regards cyclical conditions of aridity and humidity. It is important to note in this connection that the balance between aggradation and degradation is nicely adjusted in an arid region where the stream gradients are steep, and that accordingly

9. Gregory, H. F.; The formation and distribution of fluvial and marine gravels: *Am. Jour. Sci.*, 4th ser., vol. 39, pp. 487-508; 1915.

small changes in the amount of rainfall, its distribution, or the character of the storms and changes in the amount and nature of the flora result in significant modification of stream habit. Even the effect of sheep grazing is recorded in the run-off, and this influence combined with deforestation has been considered by many investigators as the sole cause of recent terracing in the plateau province. *For the Navajo country these human factors exert a strong influence, but are not entirely responsible for the disastrous erosion of recent years. The region has not been deforested; the present cover of vegetation affects the run-off but slightly,<sup>1</sup> and parts of the region not utilized for grazing present the same detailed topographic features as areas usually overrun by Indian herds."*<sup>2</sup>

The factors above mentioned no doubt aided in building up or degrading the fluviatile valley floors; but it would seem to the writer that possibly the main agent in causing the aggrading of the valley floors was man.

The Hopis (and occasionally the Navajos) of to-day build dams and ditches to direct the flood waters of the respective washes and also to prevent canyon cutting; also a series of check dams are often built along moderate slopes and along small washes to retard the run-off and to impound water for stock and house use. Occasionally the valley sides are terraced to prevent arroyo cutting. The dams, which are about five feet in height, are of earth, and consequently have to be put in annually. Though requiring a great amount of work, through this ponding of water and the diverting of washes, water is furnished for much of their stock, and over 20,000 acres of land is irrigated.

In the long-ago, when this region was densely populated, as will be shown later, each little wash and flat had its village, and the water was carefully husbanded in the irrigating of the necessary fields and was impounded by reservoirs and check dams for village use. At the present time more than 90 per cent of the flood water escapes down the washes. The escape of the flood water then was nil, and probably this condition existed for thousands of years. As evidence that such damming and diverting of water was practiced by the ancients of this valley, fragments of check dams of loosely piled stone arranged on sloping rock benches and on the terraced floors of the washes may be seen near many of the ruins of the ancient cliff houses and villages of this region. This reduced the water run-off to the minimum. As a result the *débris* brought down from the mesas by washes was left on the fields and deposited as fans over the valley flats. As no water ran down the main channels, they gradually filled up. Wind action no doubt played a part in filling up these valleys. However, there is no evidence that a sand dune closed any part of Laguna creek so far as examined by the writer. On the contrary, its banks are clays, pond deposits (including layers filled with snail shells), and wash material. In time the drainage became wholly blocked, not because of a lack of rain water sufficient to carry off the *débris*, but because man used the accumulating waters for his own use. Outrushing washes descending from the higher areas also now and then pushed their dry fans farther and farther across the region till the valleys were wholly dammed and the excess water impounded in shallow lakes. Then by this same process the valley flats were gradually aggraded. That this valley filling occurred since the coming of the villagers is evidenced by the presence of pottery, corn cobs, kitchen refuse and occasional walls of rooms, buried beneath the filling of the terraces, now ex-

1. Loc. cit., p. 119.

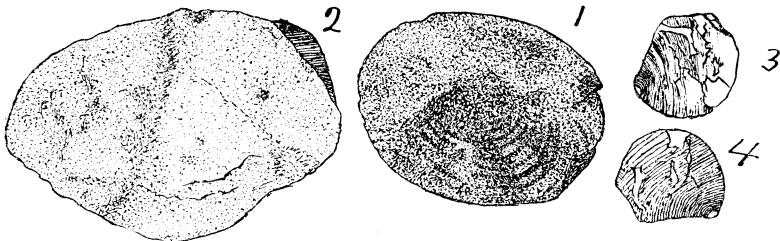
2. The italics are the writer's, to show a part of Mr. Gregory's writing that will be of interest later in this work.



posed in the banks of the present streams. The villagers and cliff people then left the region. The region then remained in a state of equilibrium as they left it for hundreds of years, except that the ponded areas probably increased in depth and the fluvial, dry ridges increased in height; for, as is well known, an established condition will remain till some excessive influence (change) overwhelms it. Thus the valley aggrading continued. Then the Navajo came with his stock and the white man with his roads and trails. The grass and herbage was short-cropped and trails led down the valleys and from the mesas and mountain slopes. Moreover, but little or no water was used for irrigation. As a consequence of these changes the rainfall rushed down the almost bare slopes, collected in the trails and rushed on toward a central point in the respective valley. Along these paths (and roads) canyons were cut and permanent channels formed. By these the waters collected in the central area in sufficient volume to commence cutting a channel to a master stream. In this manner Laguna creek was formed, and in the same manner the Tokas Jay is cutting northward now from Moenkopi wash, and a branch of Laguna creek is cutting southward from Marsh pass. This cutting will continue till man again arrests its progress.

This building up of the valley floor will again receive notice when the ruins of the region are considered.

**CRETACEOUS.** The Cretaceous is represented by the Mesaverde formation, Mancos shale, and Dakota sandstone, comprising, in the main, what is known as the Black mesa series. They are all coal bearing and possess great potential value.



Fossils from the Mesaverde formation from the coal mine at Chilchibito. No. 1 is *Inoceramus* sp., and is from an impression left by a cast. The others have not been identified. Drawings by Clarence Taptuka, a Hopi Indian.

**Mesaverde formation.** This formation caps Black mesa in the area mapped. For the most part it is composed of sandstone and shales with coal. It contains much more coal than the Mancos, next described, the coal is a better grade, and the beds in general are thicker and more constant. There are several operating mines in this formation. Two thousand tons a year are mined by the government for the Keams Canyon school. A section at this mine is here given:

	<i>Feet.</i>	<i>Inches.</i>
1. Coarse sandstone and conglomerate .....	190	0
2. Fine, white to gray sandstone .....	37	0
3. Shale .....	1	6
4. Coal, including lenses of shale .....	3	8
5. Shaly sandstone and shale .....	3	1
6. Coal, containing two small lenses of shale.....	5	9
7. Sandstone .....	71	0
	<hr/>	<hr/>
	312	0

A section at Chilchinbito Spring, twenty-two miles southeast of Kayenta, also gave the following:

	Feet.	Inches.
1. Thick-bedded sandstone (estimated) .....	457	0
2. Shale, carbonaceous matter and small lenses of coal.....	3	7
3. Thin-bedded sandstone .....	16	0
4. Coal .....	1	6
5. Shaly sandstone .....	1	7
6. Coal, including a foot stratum of gray shale.....	4	3
	483	11

The Marsh pass school gets its fuel supply from a mine here. Six seams of coal have been observed in this vicinity, one 9 feet in thickness.

*Mancos shales.* These shales outcrop all around the west, north and east faces of Black mesa as far as visited by the writer, forming a narrow black belt overlying the Dakota. Its thickness ranges from 300 to 600 feet. As suggested, it is a black shale series, though sandstone and other colored shales also occasionally met with. This formation carries much coal. At the northeast terminus of the mesa the coal is "bony." None so far examined is merchantable, though some of the seams are thick; but further south the coal becomes purer and is workable. The Tuba Indian school is supplied with coal from a mine in this series. A section of the formation as exposed in the vicinity of this mine is as follows:

	Feet.	Inches.
1. Yellow to dark arenaceous shale .....	11	0
2. Coal .....	1	6
3. Shale .....	2	0
4. Coal with a foot lens of bone (mined).....	7	6
5. Brown and gray shale .....	6	0
6. Thin beds of coal interstratified with shale.....	16	0
7. Buff sandstone, followed by shale, including coal lenses.....	15	0
	69	0

Twelve seams of coal are known to exist in the Mancos shale of this mesa, one approximating six feet in thickness; also at all locations examined the position of the sandstone is favorable for mining.

*Dakota Sandstone.* The Dakota formation underlies the Mancos and overlies the McElmo (at least at the north). It is several hundred feet in thickness and forms a band surrounding Black mesa, so far as visited, with an occasional outlying patch, the largest patch being White mesa west of Red lake. It terminates at the top in a yellow sandstone which in places exceeds 60 feet in thickness and often forms the cap of outlying branches. Underneath this cap are 200 feet of white, slightly greenish, friable sandstone and sandy shale. The formation, too, is coal bearing. The coal found in it in Three Mile wash south of Kayenta and at several other places along the north, northeast and west faces of the mesa seldom attain a foot in thickness. The coal was found to be very variable in extent, was always impure, and was found rather to be in short or long lenses than in seams. Also at several places examined between Chilchinbito and Marsh pass coal seams were observed to be from four or five to ten inches in thickness, consisting essentially of carbonized plants embedded in sand and clay. This was especially noticeable in the Three Mile wash district. So far as present criteria indicate there is no merchantable coal in this formation.

*General remarks on the Cretaceous formation.* Coal outcrops can be seen all round Black mesa, which is composed wholly of Cretaceous rocks. These

outcrops often range from three to five feet in thickness, one or two seams exceeding even that. The region is so far untouched. Professor Gregory, of the United States Geological Survey, and many other geologists estimate that this field contains eight billion short tons of workable coal, and it is the writer's opinion that it will probably exceed that amount. On account of the crumbling nature of the Cretaceous and also of the underlying McElmo formation, cliffs suitable for cliff houses are seldom formed. As a consequence, the ruins in the region covered by these formations are practically all of the village type.

**JURASSIC.** The Jurassic system is composed of the McElmo formation (?) and the Navajo sandstone series. The Navajo sandstone with the underlying Chinle are harder than the Cretaceous rocks and are cliff-forming of the durable type. In the regions covered by these formations are numerous cliff ruins; in fact, every canyon has its system of such ruins.

The McElmo formation is composed of soft, fine-grained, green, white and banded sandstone and shales. It fringes Black mesa at the west and north and extends far westward in the Red lake region. It easily disintegrates, and the region covered by it and in its lee is often a bad sand-dune-swept area. The formation is probably 500 feet thick.

The Navajo sandstone series is composed of light-red, fine and variegated, massive sandstone which is cross-bedded to exaggeration. It often exceeds 500 feet in thickness and covers the entire plateau west of Black mesa west of the Kayenta-Tuba wagon road, except the small area covered by the McElmo formation. The Segi and Tyende mesas west and north of Kayenta and Comb ridge are also composed of it. It is noted for its permanent cliffs, as we have seen, and for the numerous potholes on its surface, which contain water after each shower. The rock is also very porous, the retained water seeping through it to emerge as springs at lower levels.

Dinosaur tracks are reported to have been found in this formation.

**TRIASSIC.** The Triassic rocks exposed are the Chinle formation and the Shinarump conglomerate.

The Chinle shows north of Comb ridge, north of Kayenta, and abuts the Segi-Tyende mesas on the east. The volcanic plugs El Capitan and Chaistla protrude up through it. It is composed of shales, with thin sandstone and limestone conglomerates. Abundant petrified wood fossils are included. It is much variegated. The formation probably exceeds 800 feet in thickness.

The Shinarump conglomerate series shows only in a little patch north of the El Capitan and Chaistla butte region north of Kayenta. It is composed of gray conglomerates and sandstone, both of which inclose much fossil wood. The formation probably does not exceed fifty feet in thickness in this region.

**THE BUTTES.** In concluding the geological discussion, a few notes will be added on the buttes of the region, as they play an important part in the myths of the Indians of the present day, and undoubtedly did with the forgotten races.

The buttes about Tuba which are conspicuous are Tuba and Wild Cat. West of the road about half way between Tuba and Kayenta is Thief rock. Back of Kayenta are the Comb ridge buttons and points (which include Moqui rock and Lion Head rock), Slim rock, and the volcanic plugs of El

Capitan (Agathla or Wool Point of the Navajos), Chistla, Porras dikes, Black rock, Church rock, and an unnamed plug toward Chilchinbito, and many volcanic dikes.

The Comb ridge teeth (and buttons), Slim rock and Thief rock are residual bits of Navajo sandstone. Thief rock, the Saneneheck of the Navajos, was so named by the natives because near it is a pothole containing water from which animals which go to it to quench their thirst cannot get out on account of the slippery rock walls. It is 6,680 feet in elevation.

El Capitan has a basal diameter of 3,004 feet, placed upon a 200-foot elevated pedestal of Chinle sandstone and shale. Its elevation above the surrounding plain is computed to be 1,225 feet. It consists in the main of breccia agglomerate which is cut by branching dikes. The sedimentary blocks through which it protrudes are more or less metamorphosed or altered to quartzite and marble. As one looks at the peak from the south, it looks like a giant dunce cap, pointing to the heavens. On the whole, it is the most conspicuous landmark in the whole region.

Chaistla (or Lazy butte), four miles south of El Capitan, also protrudes through the Chinle formation. Like the latter, it is composed of breccia to agglomerate of basal igneous fragments, shales, limestone and sandstone. It looks like a giant mitten with the back of the hand to the south and extended thumb projecting eastward. Its basal area is about 1,031 by 704 feet. Its height exceeds 400 feet. There are several other minor volcanic buttes in this same vicinity.

Black rock, about three miles east of the school, consists of two dikelike masses, composed of agglomerate and breccia, and of sandstone and minette of the augite-minette type. The trend of the mass and dikes is N. 40° W. It protrudes through Navajo sandstone, which is much inclined on its eastern side, and is also much metamorphosed. In the northwest section the remains of a crater, in pot shape with broken north wall, can be clearly made out. The elevation of the main mass above the surrounding plain is over 300 feet.

Porras dikes include various dikes and necks extending in a north-and-south direction for more than a mile. They are composed of breccia and agglomerate, intersected by dikes and sheets. The included materials are in all kinds of shapes, and include granite, sandstone and igneous rock blocks ranging from the size of pebbles to blocks weighing many tons. The group protrudes through Navajo sandstone (and Chinle rocks at the north terminus). In elevation they stand 300 feet above Comb ridge, which they top, or 700 feet above the floor of the adjoining valley. A spur dike leading out from this group also extends as a giant wall far to the southward south of Laguna creek.

The volcanic plug with its radiating dikes north of Chilchinbito much resembles Black rock, previously described. Its base is also of about the same area, but its height is considerably less. The formation through which it protrudes is McElmo.

Church rock is 300 feet in height, culminating in a pointed tower, suggesting its name. It has a large rectangular base with the longer axis running nearly north and south, from which a dike extends southward across the valley into the adjoining mesa to the southward. The butte is composed of included dikes surrounded by giant breccia or agglomerate of igneous fragments and sandstone blocks. It protrudes through Navajo sandstone and McElmo rocks. Standing in the valley of Laguna creek, it makes a picturesque landmark.

The lava which was hurled out by these craters and dikes has been wholly removed. Also probably 2,500 feet of the existing strata at the time of the upheaval have also been carried away by wind and water. Professor Gregory records that volcanic ash and other volcanic material are interstratified with the Tertiary that overlies the Mesaverde of the Moqui country and the south edges of Black mesa. In the Moqui region the volcanics overlie the Tertiary; elsewhere they are interbedded with the clastics. The edge of the Tertiary in which these volcanics are interbedded is yet undetermined.<sup>3</sup>

It is the writer's opinion that the included lavas in the Tertiary just to the south of the region mapped were hurled out, in part at least, by these volcanoes; or the volcanoes of this region were at least active at the same time. No remnant in the vicinity of the buttes is now capped with lava or has lava or ash interstratified with its rocks. It is therefore evident, it seems, that the original surface at the time of the eruptions has been wholly removed. This erosion has removed the Tertiary (?) wholly from the region, has reduced the Cretaceous to the limits of Black mesa, has removed the McElmo from the greater part of the area, and has made great inroads in the Navajo, Chinle and Shinarump rocks.

In 1903 the writer made a study of the lavas of the plateau region, coming to the following conclusion:

"It is evident that eruptive activity has occurred in the plateau region from Cretaceous to recent time, and at least three well-defined epochs are at present recognizable and at least two distinct kinds of lava flows, viz.:

"1. The ancient volcanic necks and laccolites bordering the Rio Grande embayment and extending west across the plateau to Salt river and Gila valleys in Arizona, begun in later Cretaceous time, the lava sheets of which have been removed by erosion.

"2. The trachyte-rhyolite lava flows of Tertiary times, which are mostly pre-Pliocene in age, and which are only partly removed by erosion.

"3. The basaltic flows and cinder cones, begun in Tertiary time and continued to the postglacial epoch, the last flows of which still maintain their original slope and extent."<sup>4</sup>

His conclusion concerning the Kayenta volcanic plugs is that they belong to the first-named group and were active at the time the region was being elevated above the Cretaceous sea, continuing their activity probably far into the Tertiary. To-day they stand as giant landmarks, indicating the colossal amount of erosion that has occurred since they ceased to be active.

#### SOIL.

The soil on the Segi mesas, Black mesa and northward from Comb ridge is thin with high porosity. The accumulated deposits in the valley often exceed fifty feet in depth, and are of a sandy constituent to adobe clay, with many grades between. Lime in composition is very small in amount, as there is but little lime in the adjacent country rock. Alkali patches are occasionally seen, but are not a prevailing feature. On the whole the valleys are fairly fertile when sufficient water can be obtained for the growth of plants.

3. See Gregory, H. E.; *Geology of the Navajo country*: U. S. Geol. Surv. Professional Paper 93, pp. 81, 82.

4. Reagan, Albert B.; *Age of the lavas of the plateau region*: *Am. Geologist*, September, 1903, pp. 170-177.

## CLIMATE.

The climate at Kayenta and Marsh pass is very similar to that of Tuba, except it is less warm in both winter and summer. The temperature ranges from 100 degrees in summer to -23 degrees in winter. The precipitation is also more than double that at Tuba.

## IRRIGATION.

A government reclamation plant was begun in Laguna valley about four years ago. A dam was placed across Laguna creek at Moqui Rock, three miles above the school, and a ditch was constructed from it past the school. By this plant, 1,000 acres of land north and east of Kayenta, including 100 acres of school land, are to be irrigated. The project was completed last fall, the total expense exceeding \$40,000. This is the only reclamation work in the region, except the few small dams and ditches of the Navajos by which an area of a few acres are irrigated here and there.

## FAUNA.

Below is a list of some of the animals and birds found in the region, with notes on same:

DEER (*Odocoileus hemionus*). A deer was killed by an Indian of Sam Chief's family just recently, and its horns are now to be found in the Buckbee-Vercamp trading store at Kayenta. Formerly deer was very plentiful. Many bones and horns of this species are to be found in the ruins throughout the entire region.

MOUNTAIN SHEEP (*Ovis canadensis*).

PRONGHORN ANTELOPE (*Antilocapra americana*).

The last two species are now extinct in the region at hand, though the antelope is seen now and then in the San Francisco mountain region. Both were very numerous formerly, as their bones in the ruins attest. They also have an important place in the pictographic writing left by the ancient dwellers, the mountain sheep being the most numerous.

PRAIRIE DOG. This animal is conspicuous and too numerous on all flats. The Navajos kill them, and removing the entrails, roast them, skin and all, in the ashes. They are said then to have a good flavor. A prairie-dog bake is a great day among them. Their principal mode of killing the animal is by drowning after a shower. The flood water is trenches to the hole, and when the animal emerges to escape the impouring flood he is clubbed to death.

JACK RABBIT (*Lepus californicus texianus*). This animal is not numerous, but is still occasionally seen.

ARIZONA COTTONTAIL (*Sylvilagus auduboni warreni*). This animal is not plentiful at present, having been killed off by a plague a few years ago. It is a burrowing animal, and, like the prairie dog, is very hard to catch. Rugs and blankets were made from its fur in the old times, both by the Navajos and by the people of the cliff ruins and villages.

COYOTE (*Canis estor*). Too plentiful.

WOLF (*Canis sp.*). Scarce.

KANGAROO RAT.

BLUE FOX. Reported to have been seen near Chinle. It is a variety.

RED FOX.

GREY FOX.

WESTERN FOX (*Vulpes macrourus*).

KIT FOX (*Vulpes velox*).

WHITE WEASEL. Lives in prairie-dog holes, feeding on prairie dogs, mice, etc.

CIVIT CAT, or spotted skunk.

BADGER. It seems to be rare, though one is now and then killed. The hide of one is now being stretched in the Wetheril & Calville store.

PORCUPINE. This animal lives in the higher regions, feeding on the bark of trees and on pinion nuts.

LYNX. Not often seen.

COUGAR. This animal is reported to have been seen in the region.

PANTHER. Reported to have been seen in the mountain districts.

BOBCAT. Seems to be very numerous. The writer counted a dozen pelts of this beast in one of the trader's stores here to-day.

BEAR (Navajo *shash*). They once lived in the lower regions of the country, but are now all gone, so the Indians report. They now live in the mountain districts.

GOPHER (*Thomomys* sp.). Only a few animals of this family have been seen by the writer.

MOLE. Very rare.

ALBERT'S SQUIRREL (*Sciurus alberti*).

TRADE RAT, or the Arizona bushy-tailed wood rat (*Neotoma cinerea arizonæ*). This animal seems to be very plentiful.

NOTE.—Bones of the jack rabbit, common rabbit and mountain sheep are plentiful in the refuse about the ruins. Those of the pronghorn antelope and deer are also sparingly seen.

Of the reptiles the following are those most seen:

LIZARDS. Several species.

SPOTTED RATTLER. Too numerous.

DIAMOND-BACKED RATTLER. (*Crotalus adamanteus*?). This snake has been seen at the government hay fields between Chilchinbito and Kayenta several times.

BULL SNAKE. Probably several species.

The birds of the region, so far as seen, are as follows:

DADCHICK (*Podilymbus podiceps* Linn.). Seen in migration.

MALLARD (*Anas boschas* Linn.). Seen in migration.

BLUE-WINGED TEAL (*Querquedula discors* Linn.) Seen in migration.

GREENWINGED TEAL (*Nettion carolinensis* Gmel.). Common in migration.

CANVASBACK (*Aythya vallisnera* Wils.). Common in migration.

WILD GOOSE (*Branta canadensis hutchensi*). Seen in migration.

LEAST BITTERN (*Ardetta exilis* Gmel.). Probably a resident. Quite common in the fall.

NOTE.—All the ducks mentioned and the bittern were seen at different times at Summit lake (the "Cedars") and about the reclamation reservoir here during the fall of 1919.

WHOPPING CRANE (*Grus americana* Linn.). Common in migration.

SANDHILL CRANE (*Grus mexicana* Mull.). Common in migration.

COOT (*Fulica americana* Gmel.). A very common bird, especially in migration.

JACKSNIFE. Seen only occasionally.

GREATER YELLOWLEGS (*Tringa melanoleuca*).

KILDEER (*Ægialitis vocifera* Linn.). Quite common in migration. It was often seen about the lakes and pools of the region. It is possibly also a resident.

MOURNING DOVE (*Zenaidura macroura* Linn.). A common resident. It is quite abundant in the Segi canyons. The bird seems to be smaller, slightly at least, than the eastern dove.

RED-TAILED BUZZARD (*Buteo borealis*). Plentiful. A reed arrow plumed with the wing and tail feathers of this bird is used much in certain Navajo rites, especially in the "shooting deity" ceremony.

WESTERN RED-TAILED HAWK (*Buteo borealis calurus*). A very common bird. It lives principally on prairie dogs and rabbits. The writer has seen one hover over a rabbit burrow for hours waiting for the unsuspecting animal to come out to sun himself.

SWAINSON'S HAWK (*Buteo swainsoni*).

WESTERN SPARROW HAWK. Quite common.

CHICKEN HAWK (*Accipiter cooperi*). It is called *gini* by the Navajos. It is quite common.

EAGLE. This bird is called *asta dine* (the people who inhabit *Yagahoka*, the heavens above) by the Navajos.

WESTERN GREAT HORNED OWL (*Bubo virginianus pelliscens* Stone). The Navajo name for this bird is *spy*.

BURROWING OWL. Very common about prairie-dog towns. They undoubtedly feed on the prairie dogs.

RED-SHAFED WOODPECKER (*Colaptes mexicanus*). A very common bird. The feathers of the radiating tail are used to decorate certain masks and medicine hats.

NIGHT HAWK (*Chordeiles virginianus* Gmel.). Very common.

CLARK'S JAY, or crow (*plicicorvus columbianus* Bon.). Often seen about the yards at Kayenta.

WESTERN STELLAR JAY.

PINYON JAY, or pine squawker. A very common resident.

HUMMINGBIRD. Seen at the head of Three-mile wash in June, 1919.

RAVEN (*Corvus corax sinuatus*). A common resident.

CROW (*Corvus brachyphynchus*, or *hesperis*, or *cryptolenca*).

YELLOW-HEADED BLACKBIRD (*Xanthocephalus xanthocephalus* Bonap.). Common in migration. It was often seen in the fall about the Kayenta oasis.

RED-WINGED BLACKBIRD (*Agelaius phoeniceus* Linn.). Quite common in migration, probably being a resident in the higher regions.

COWBIRD (*Molothrus ater* Bodd.).

MEADOW LARK (*Sturnella* sp.). Seen in the Segi canyons. It was also observed singing on the government meadow between Kayenta and Chilchinbito, April 24, 1919.

BRONZED GRACKLE (*Quiscalus quiscula arvens* Rigw.). Only a few birds of this species were seen.

ENGLISH SPARROW (*Passar domesticus* Linn.). Too numerous. They are a terrible pest at the school. Meat cannot be hung out in winter, as is the custom in this region, on account of these pests. They first eat out the tallow or other fats, and then the lean meat. They also eat up the young garden stuff and the repening grain.

JUNCO species.

TREE SPARROW.

LARK BUNTING (*Calamospiza melancorys* Stejn.). Seen in migration.

CLIFF SWALLOW (*Petrochelidon lunifrons* Say).

WOOD THRUSH.

ROCK WREN.

NUTCRACKER.

ROBIN (*Merula migratoria* Linn.). Often seen, but it is not known that it is a resident. Several of them froze to death in the early blizzard that overtook the country November 26, 1919.

WESTERN BLUEBIRD.

WILD TURKEY. This fowl is still occasionally seen in the higher regions. It was domesticated by the cliff dwellers. Its feathers were woven into cloth and also used in the ceremonies.

#### FLORA.

The following plant zones are represented in the region: Little Colorado area, 3,500 to 5,000 feet elevation; zone of sage brush, 5,000 to 6,000 feet; zone of pine and pinyon, 6,000 to 7,000 feet; and the zone of yellow pine, 7,000 to 8,500. The plants so far identified by the writer are:

HORSETAIL (*Equisetum hiemale*).

JUNIPER (*Juniperus occidentalis*). At 6,000 to 7,000 feet elevation.

JUNIPER (*J. monosperma*). Same range as above.

RED CEDAR (*J. virginianus* ?).

*Juniperus scopulorum* Sarg.

JUNIPER (*J. utahensis*). This species is commonly called cedar.

OAK JUNIPER (*J. pachyphloea*). Reported in the region, but not seen by the writer.



PINYON (*Pinus edulis*). At 6,000 to 7,000 feet elevation.

PINYON (*P. monosperma*)?

PINE (*P. ponderosa*). At 7,000 to 8,500 feet elevation. It grows to 80 feet in height. The Indian Office estimates that 1,550,000 feet, b. m., of this pine are to be found on the Segi and Black mesas and about Navajo mountain, growing mainly in the upper reaches and in sharp canyons. The pine logs used in the reclamation dam at Moqui rock near Kayenta were obtained from the Segi.

DOUGLAS FIR (*Pseudotsuga mucronata* [Raf.] Sudw.). This species occurs in small groves. It is more abundant near Fort Defiance.

SPRUCE (*Pseudotsuga taxifolia*). This species is scattered here and there in the high canyons, 7,000 to 8,000 feet in elevation. It is used in the Navajo ceremonies and in certain of their rites.

ENGLEMANN SPRUCE (*Picea engelmanni* Parry). At 7,000 to 8,500 feet elevation. The Indian Office estimates that there are 12,000,000 feet, b. m., of this species in the Navajo country. This species is principally seen in the region east of the country covered by our map, principally on the Fort Defiance plateau, etc. It grows in small groves.

MOUNTAIN MAHOGANY (*Cercocarpus parvifolius* Nutt.). Sticks of this species are used in the "night chant" of the Navajos, and are also found in the ruins of the region.

CHERRY. The cherry bark and also the wood are used in the "night chant" ceremonies.

*Forestiera neo-mexicana*. This species is used in the "night chant."

COTTONWOOD. Several species are represented in the region, among which are *Populus monilifera*, *P. wislizenus*, *P. acuminata*. They are found at altitudes ranging from 7,000 to 8,000 feet.

QUAKING ASPEN (*Populus tremuloides*). At 6,500 to 8,500 feet altitude. There is quite a grove at the head of Three Mile wash, and several groves in the Segi mesa region.

OAK (*Quercus gambellii*). This species is found in close-set groves in moist places at all elevations. A large patch heads Three mile wash. A large patch is also to be found both at Betatakin and Keetseel ruins in the Segi region. A large grove used to also occupy the site of Kayenta. The groves are mostly on the north slopes of the mountains and mesas.

BOX ELDER. This tree is found growing in protected, moist places, usually along the north walls of canyons or mesas. A clump is to be found on Laguna creek about five miles below Kayenta. The front of cliff cave 96 is studded with box-elder trees. Several clumps were also seen in the Segi region, and two in the Three Mile wash section.

WILLOW (*Chilopsis linearis*). Baskets from this plant were made by the ancients.

DWARF CHOKE CHERRY. This shrub was seen in the vicinity of Keetseel.

WILD CURRANTS. Two species. These were seen near Keetseel. They were found in the canyon.

GOOSEBERRIES. These were also seen near Keetseel.

CLIFF ROSE (*Cowania mexicana*). Indian name, *awetsal*. A pipe and stem is made from this plant. The pipe is painted yellow and is used in some of the Navajo ceremonies.

AROMATIC SUMAC (*Rhus aromatica*, var. *trilobata*). Rather rare. Baskets are made from the twigs of this plant.

COMMON REED (*Phragmites communis*). This plant is used in making flutes and whistles. It is also used in making the ceremonial cigarette of the Navajo. The reed is cut off between the joints (nodes) with a sharp, white stone. It is then rubbed with sandstone, after which it is painted. A wad of feathers is then put in it to hold the tobacco in the hollow. It is then filled with tobacco and smoked, the smoker puffing a puff of the smoke in turn toward each of the cardinal points, beginning at the east. This act is a prayer.

NATIVE TOBACCO (*Nicotiana attenuata*, and *N. palmeri*). Rare. It is much used in the rites, and was so used by the cliff people, as their pipes indicate.

RABBIT BRUSH.

SAGE BRUSH (*Artemisia*). At 5,000 to 6,000 feet elevation.

GREASE WOOD (*Sarcobatus*). Same elevation as above.

WILD FLAX. Found in the lower levels.

*Sporobolus cryptoandrus*. The seeds of this plant are ground and used in certain ceremonies.

**YUCCA.** The yuccas are quite abundant. The principal species seen are: *Yucca baccata* Torr. *Y. angustifolia*, *Y. glauca* Nuttall, *Y. radiosa* Trelease, and *Y. elata* Engl. The first two are the ones most usually seen, though the second is the most abundant. Masks are made from the leaves of the *Y. baccata* (Spanish bayonet), the masks being used in the "night chant of the Navajos. The plant is called *hashkan* by them. It is the coarser of the yuccas represented. Drumsticks are also made from its leaves. Its fruit is edible. It is known to the natives as "banana yucca," on account of the bananalike resemblance of its fruit. The fruit is roasted in the ashes by the Indians, much as potatoes are roasted, it then having a fruity flavor to a slightly burned-squash taste. A dinner of yucca fruit is a feast for any Navajo. Both the plant and fruit are used in the magic ceremonies of the fire dance. All the yuccas are used in the Navajo rites. Counters in their games are also made from the leaves of *Y. glauca*. The roots of all the yuccas have soapy properties and are used for washing purposes. All have fibrous leaves, which are used by the natives for cordage. Among the cliff dwellers of the region this fiber was used for making thread, ropes, matting and cloth. The Kayenta ruins have yielded much fabric made from this material.

**CACTUS.** The cactus family is represented in the region, but is not as plentiful as farther south. The principal species so far seen are cane cactus (*Opuntia arborescens* Englm.), round cactus (*Mammillaria* sp.), a flat-leaved cactus, or prickly pear, and the sitting cactus (*Cereus phaniceus*). The cane and flat-leaved varieties seem to be the most numerous.

**SCATTERED BONE MEDICINE** (*Arabis holboellii* Horneman). Indian name, *azeladiltehe*. It does not grow in heads or clusters, but usually singly.

*Cutierrezia enthamia*. This is a weed under which the Navajo place their sacrifices in the "shooting diety" ceremonies. It has a yellow, composite flower. Its Indian name is *tsildilgisi*, or "hiding weed."

*Verbesina encelioides*. Indian name, *indigili niltsoni*, or "strong-smelling flower." A cigarette is made from this plant. It is painted white. When finished it is placed over the door of the hogan in certain ceremonies.

**TUMBLEWEED** (*Amorantus albus*). Indian name, *tlotahi nagisi*. The seed of this plant and allied species used to constitute an important diet of the Navajo, and is still more or less used. It has also been found in jars in the cliff houses.

**MARIPOSA LILY.** This is a very prominent and beautiful flower on the sand-covered benches between Tuba and Red lake in June each year.

**SEGO LILY.** This plant grows profusely throughout the region.

**FIREWEED.** This plant is not common, but is occasionally seen.

**MUSTARD.** This family is fairly well represented.

**WILD HOPS.** Several vines of this plant were seen near Keetseel.

**WILD CURRANTS.** Two species. These are very plentiful about Keetseel. Wagonloads of the fruit could be picked annually, but it seems that no one cares enough for them to pick them. The fruit is sweeter than the eastern currant.

**RAGWEED.** This plant was seen in the vicinity of Keetseel.

**DESERT PRIMROSE** (*Lavauxia primiveris*). This plant is very common.

**SNOWBERRY.** This plant was seen in the vicinity of Keetseel.

**ARIZONA DANDELION** (*Malacothrix glabrata*). This plant is often seen.

**INDIAN PAINT BRUSH** (*Orthocarpus purpurascens*). This plant is seen now and then on the north slopes.

**OWL'S CLOVER** (*O. purpureoalbus*) is occasionally met with.

**PLANTAIN** (*Plantago* sp.). Several plantain plants grew in the school yard in 1919.

**PIGWEEED**, or desert lamb's-quarter (*Chenopodium incanum*). It covers the flats in summer and makes much pasture for the sheep.

**RUSSIAN THISTLE.** This plant is a recent comer to the region. It is prolific and is driving out many of the native plants. It makes good pasture for stock, especially sheep, when young and tender, but as it ages it gets spiny and hard. It is said to make fairly good hay when cut at the right time.

**MALLOW.** Several plants of the mallow family (*Sphæralcea* sp.) grow here, one very small, one very tall.

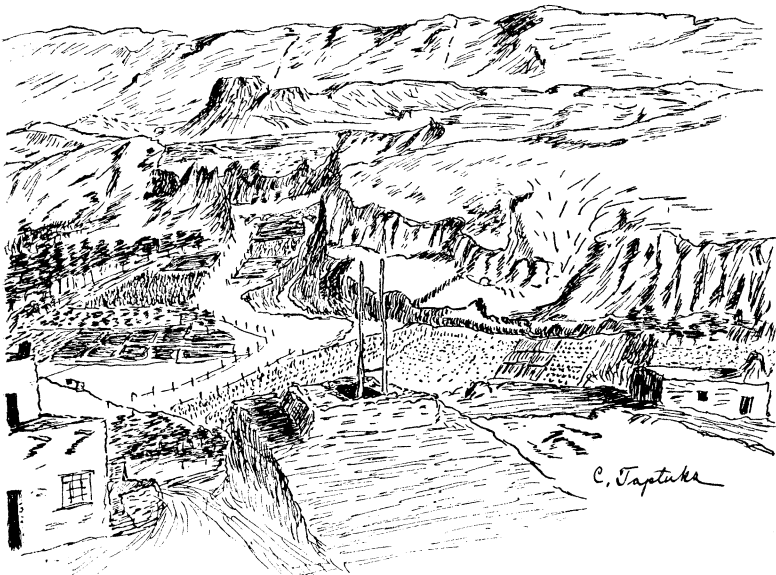
**PURSLANE.** Several species of the purslane (*Portulacææ*) family are seen now and then; also the carpet weed.

**JIMPSON WEED** (*Datura meteloides*). The flowers of this plant are very long. Their color is white, tinged with lilac on the outside. In the hotter parts of the day they droop like wet tissue paper. The leaves of the plant are very large. The Navajo medicine men use the juice of this plant and the flower as medicine. It has effects similar to the payote bean, reacting on the patient much like the "hasheesh" does on the dervishes of the East. It also makes the pulse run high and a delirious stage is very often reached. During the "flu" epidemic it was much used by the medicine men as a remedy. One patient who had been treated by a medicine man with this "medicine" was found by the agency physician, Doctor Reynolds, to have a pulse running as high as 240. She recovered and is still living. When under the influence of this drug the natives also often reach the stage of perfect frenzy, at which times they shout, gesticulate, dance and prophesy.

In closing his remarks on the flora and fauna of the region the writer wishes to add that most of the animals, birds and plants mentioned above are represented by fragments in the debris of the cliff houses and village ruins of the region, or by pictographs of that race found chiseled along the canyon walls.

#### HUMAN HABITATION.

When the white man came to the region he found the Navajo in possession, as he is to-day; but before the coming of the Navajo another race made it their abode for a very long period of time. This race was the cliff- and village-house people. Their ruins dot the country. Below is a description of same in the order as examined by the writer.



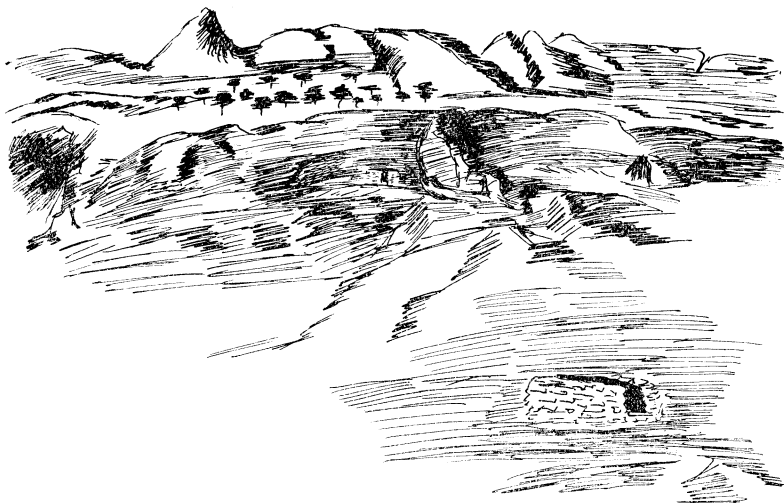
Moenkopi canyon, looking east from the Kiva at the Indian village of Moenkopi. It shows the country over which Farfan, Ovate and Espejo traveled in coming to Moenkopi from Oraibi and Awatobi.

*Ruins from Tuba to Marsh Pass.*

Many ruins dot the valley between the entering of the Tokas Jay wash below Red lake and Marsh pass, but time would not permit the examining of most of them. Those visited are here given.

Some years ago some one started a trader's store up against a mesa on the west side of the Tokas Jay some miles south of the present Red lake trading post. The walls of the abandoned store still watch over the site. Some distance above (north) this store on an adobe flat, which is now trenched by washes, are parts of walls of an ancient village. Much pottery shards dot the site. From general appearance the village was rather large.

There are prehistoric burials about Red lake. Traders there told the writer that many skeletons and much beautiful pottery had been found in that vicinity. The country there is a sand-dune region and the former burials are



By C. Taptuka

A cave-cliff house northwest of Kayenta.

uncovered by the wind. The writer saw much of the recovered pottery, but his short research period there failed to disclose the village or villages which are undoubtedly there and from which the burials were made.

In the vicinity of Cow springs there are several ruins. On a sand ridge over which the road crosses, about a mile east of the springs, there are the remains of a large ruin now leveled, and represented only by grinding slabs and the broken pottery which cover the whole hillside. Judging from the abundance of the broken pieces, at least 500 people must have occupied the village. Leaving these springs, village mounds were then passed one after another. One of the ruins, situated westward from the road on a promontory on the edge of the plateau, still has high walls standing. Another small ruin was passed near the road about half way between Cow springs and the sand hills. It appeared to be the remains of a small pueblo. Another lies about a quarter of a mile west of the road, across a mud flat that becomes a shallow lake in the rainy

season. This ruin centers about a rocky hill, which has a basin area to the northward and to the northwest as well as to the east, a wash entering these flats from the west-northwest. On the rock knoll are rock walls of former houses still standing. They were built in rectangular form in a north-south direction. The ground plan of quite a number of rooms can be made out. About this knoll in the flat above the water line, especially to the eastward of the knoll, there is evidence that there was once a very large adobe village, now wholly leveled. Metates and manos and a large quantity of broken pottery now mark the site. It is easy to assume that the stone-walled structure on the knoll was the citadel of the place, around which was clustered an extensive village built of less durable material. The inhabitants of this village depended on this shallow pool and its accompanying wash for their village water supply and for irrigating their crops on adjacent fields. More extended investigation than the writer had time to make will probably disclose check dams and reservoir dams on the wash mentioned, placed to inclose a permanent water supply, as in many cases which will be cited later. If the water could be impounded that descends from the mesas to the northwestward through this wash, and the same held for use as needed, a large village and a considerable area of land could no doubt be irrigated and furnished water as needed. In August, 1919, the writer, in company with Mr. C. Calville, came from Tuba to Marsh pass in an auto. Clouds hung off to the northwestward over the mesas, but it had not rained in the valley. Coming to this flat, in the outwash area from this wash, we found the water four feet deep, a mile wide and four or five miles in length, with a rapid current flowing toward the south. As a result they had to go to the hills to the eastward to get around this flood. Could this water have been impounded, as the village people no doubt impounded it, it would have lasted a long time for village use and necessary irrigation. It is also quite likely that those ancient people's fields were in the flats mentioned, which, that the check dams and reservoirs are obliterated, are now flooded after every rain.

#### *The Marsh Pass Ruins.*

The next ruin seen was in the vicinity of Cedar ridge. From this to ruin A, near Marsh pass, twenty-six ruins were observed. They were situated mostly along the northeastern side of the valley, along the rock slopes toward Black mesa, on the first rises of land toward that mesa, or on hummocks of sandstone at the east edge of the valley. Some also were perched on adobe flats, some on bare rock. They were all observed to be much tumbled down, usually piles of building stone, with a wall occasionally projecting. About these sites and on the slopes and in the valleys below them are great quantities of broken pottery. The writer was also advised by Indian Agent Walter Runke that the canyon leading to the former Marsh pass coal mine in this valley contained many similar ruins to those found in the valley.

*Ruin A.* This is "ruin A" of Fewkes,<sup>5</sup> Cummings,<sup>6</sup> and Kidder and Guernsey.<sup>7</sup> The ruin stands on the west edge of a promontory northwest of the

5. Doctor Fewkes; Navajo national monument paper: Bull. 50, Bureau of American Ethnology, Washington (1911), p. 10.

6. Cummings (1910), pp. 28, 29.

7. Kidder and Guernsey; Archæological explorations in northeastern Arizona: Bull. 65, Bureau of American Ethnology, Washington (1919), pp. 61, 62.

road, and can be seen for miles. It consists of a long building, extending approximately in a north-south direction. It is 30 steps long by  $10\frac{1}{2}$  feet wide, with a heavier low wall extending from it both at the north and south termini, as is shown in the plate. Part of the north end and all of the south end have fallen out and the two parallel walls have been broken through. The building was evidently once two stories high. Some cedar poles of the second-story floor are still in place. The rock of the walls was well laid in adobe mortar. The outer surfaces were polished, apparently having been polished after the wall was laid. There are slight evidences that the inside of the wall was plastered with adobe. Some "sculpture" work on the rocks of the walls was also incised. About this ruin there are but few pottery fragments, and, from appearance, it was never occupied as a dwelling. Remains of at least three large villages are on the east and south slopes of the same



Betatakin.

promontory on which this ruin is situated, all within 600 yards of it. From all appearance the writer must agree with Doctor Cummings that the standing building probably represents the "fort" or citadel of these adjacent villages. For further reference to this ruin the reader is referred to the references in the footnote above.

*Ruin B.* This is "ruin B" of Fewkes<sup>8</sup> and "ruin 8" of Kidder and Guernsey.<sup>9</sup> It is in a cave high up on the rock wall of the mesa to the left of the road as one approaches Marsh pass from the south. It stands bold to view over a bench across a gulch, and it, with its inclosing cave, reminds one much of a giant, distorted mouth with broken teeth (the crumbling house walls) projecting upward in an irregular line from the lower jaw. The ruin was undoubtedly built there for defense on account of its protecting rock walls and its almost inaccessible approach. It seems to have been built after the "tower house," which stands on a spur just below it (ruin B), as fragmentary rock

8. Fewkes; loc. cit., pp. 10-12.

9. Kidder and Guernsey; loc. cit., pp. 56-61.

like the polished glyph-cut rocks of that ruin are incorporated in its own roughly built walls. The remains of twelve rooms, a tower and two kivas still show.

Below ruin B, on the floor of the creek that enters Segi canyon from the south, under a rock ledge of the adjacent mesa to the left of the road, are fragments of walls of a once small village. It is in plain view from the road, and while inconspicuous in comparison with the other ruins of the region, it shows how the peoples of that distant time utilized every possible place of protection the region could afford.

*Ruin C.* Just below the mouth of Segi canyon, adjacent to the rock walls of the mesa west of Laguna canyon (creek), are low mounds of what appears to have been a large village in the open. The site is marked by building stone and broken pottery. Opposite it, in a small recess under a large outstanding rock, is what was probably a granary. The recess is walled up across its front, with a small doorway about 18 by 20 inches still intact.

*Ruin D.* As the road descends Marsh pass to the flats to the northward it passes over a small ruin, now mostly represented by broken fragments of pottery. It is not likely that more than fifty people ever lived in this village.

In the pass between ruin A and ruin C there are fifteen ruins, all of small size. In Kinboko canyon, that ascends southwestward from ruin A, there are three caves which seem to have been the burial places of the basket-maker village people, likely the first villagers who came to the region. And along the comb and in caves in it north of ruin C in the first four miles there are five other ruins, one of them being the famous "Sunflower cave," from which twenty-five wooden "sunflowers," two buckskin sunflowers, a carved wooden bird, and twenty-five varnished, cone-shaped objects were obtained. All these ruins have been described or more or less mentioned by Kidder and Guernsey to whose work the reader is referred.<sup>1</sup>

#### *The Ruins in Segi Canyon.*

The ruins in the Segi canyons and Segihatsosi exceed twenty-six in number. Outside of Cliff Palace, two of these ruins, Betatakin and Keetseel, are two of the largest cliff ruins in the United States. They seem for the most part to have been discovered by the Wetherils, who also discovered the Mesa Verde ruins. Richard Wetheril visited Keetseel as early as 1894 and 1895, and Betatakin was discovered by John Wetheril in 1909.

*Keetseel and adjacent ruins.* Keetseel is at the head of what is known as Middle canyon of the Segi group of canyons, some seventeen miles up the canyon from Marsh pass. Above it the canyon becomes boxed. The ruin is well preserved. The rooms, including the circular kivas and rectangular kihu, probably exceed 150 in number. The length of the village is about 300 feet. It is picturesquely perched upon a bench under an overarching cliff of Navajo sandstone, which completely overtops it, though there is evidence that village rooms in the flat abutted this bench, some rooms of which still remain in a fairly good state of preservation. The ruins also continue on southward from the ledge over 100 yards to the end of the curving wall that hoods in and backs the main ruin. A huge log, thirty-five feet in length, extends across an open space in the building plan, and probably once supported

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1. Loc. cit., pp. 61-97.

a retaining wall, which has since slid down the sloping bench, leaving the log over the gap. Another noticeable feature was that the walls of many of the rooms were found to be formed by twigs, limbs or poles being placed in upright position, over which adobe mud had been plastered. Other walls were made by rows of sticks interwoven with twigs, over which adobe plaster was daubed. Such walls are also found at Betatakin. The burned ruins in the Pine-river region showed that their walls had been made in this manner, but these are the first walls of that type seen by the writer. Another thing about these ruins that the writer wishes to mention is that at the base of the detritus in the canyon adjacent to this ruin are imbedded pottery and village implements, which shows that there was a ruin in the vicinity before the valley fillings were placed there by water and wind. This village, stipulated so as to face the morning sun, must be seen to appreciate the impressive vastness of itself and its overtowering arch.<sup>2</sup>



Keetseel.

About Keetseel are clustered quite a group of ruins, probably ten within a radius of five miles. Those visited by the writer are as follows:

*Ruin E (Turkey House).* This ruin is one-fourth mile around a rock corner north of Keetseel, in a *rincon* corner on the same side of the canyon. Mr. Cummings' party excavated a part of it in 1911, so a notation on the wall of the canyon states. Thirteen rooms and parts of two estufas show. The walls of the north estufa (kiva) still stands five feet high. A corn-grinding mortar box with metate is in place, as is also an inclosed fireplace with ashes in it. Its diameter is about fourteen feet. The south kiva has a front-fire chimney (ventilator), and a fireplace, north of which is a small, rectangular inclosed space one foot long by eight inches wide, inclosed in four rock slabs. Two posts that helped support the roof are still in position, though their tops have been removed. This kiva also has a metate box with metate in place,

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2. See Fewkes, loc. cit., pp. 16, 17, for a further description of this ruin.



and a chink in the wall to place the metate when not in use. It is also a six-pilastered kiva. The village was very extensive.

*Ruin F.* Just above an east entering wash across the canyon from ruin E is a small cavelike room space against the west face of the canyon walls. A ruin occupies the site. Part of one room remains standing.

*Ruin G.* On the east side of a rock point north of the creek, about one-half mile east of the Keetseel creek junction with Laguna creek (Segi canyon), there is a cliff ruin about 140 yards in length, running along a shaly, nodually ledge between massive ledges of sandstone. The rooms were excavated wholly or in part. Part of the walls of two rooms and one whole room still remain. The depths of the rooms were from five to seven feet; height, less than five feet. The door seen was less than two and one-half feet by two feet.

*Ruin H.* About 300 yards north of ruin G, on an east-and-west-running cliff extending eastward from the cliff along which the latter is located, there is a small cliff ruin in a naturally worn ledge under a sandrock cap roof. The ruin



Wickerwork adobe-plastered walls, Keetseel.

seems to be composed of three rooms. It is high and at present inaccessible, as the approach to it is worn away. On a long, sloping surface leading toward it from the south are the pounded-in footholds on which that happy people clambered in the long ago.

*Ruin I.* East of the next point north of the creek, east of ruin H, there are indications of a ruin on a little knoll. Some pottery, metates, etc., show; also a fireplace box and part of a wall.

*Ruin J.* About a half mile east of ruin I there are the remains of two very small ruins in the open, one on each side of a south-flowing arroyo.

*Ruin K.* South of a bluff north of the Segi (Laguna) creek, at the falls, is a single room dug into a soft streak in the ledge. Only a part of the walls show. The ruins here were probably more extensive, but have been removed by time.

*Ruin S—The Swallow Nest Group.* Possibly five places where rooms could be built up high just under the cap rock, two of which now have rooms, show from the trail. Swallow's nest is the largest and most conspicuous. It fills the bottom of a vaulted, symmetrically formed, open cave. Seven rooms are more or less intact, some more than one story high. The ruin was found to be in a poor state of preservation. It is the first cliff dwelling as one ascends the canyon from Marsh pass.

The other large ruin in the Segi, as noted, is Betatakin, or "High Ledges House." It is situated in a canyon that leads off to the left from the main Segi (Laguna creek) canyon about five miles above Marsh pass. The ruin is about two miles up this side canyon. It is situated on a bench under a great arch facing the morning sun, as was Keetseel. It was 600 feet in length and was probably originally a much larger village than Keetseel, but has suffered more by the ravages of time. More than 100 rooms are probably now visible. At least two of these are ceremonial rooms, but, differing from the Keetseel kivas, they are rectangular in shape; no circular kivas were seen. Eylets were also seen cut in the side of the cliff, problematically for the placing of beams in house construction. This ruin also differs from Keetseel by its having a "gallery"—a group of rooms upon a shelf much above the main ruin, to which access could only be had by a long pole ladder. This was probably the citadel of the village. A dripping spring is situated near the ruin and probably furnished the water for village use in that far-off time. The walls of the village have been partly restored and strengthened by the government. On the canyon walls adjacent to the southeast are drawings of a shield and a mountain sheep. In approaching this village, as with Keetseel, one is struck with awe, some with a sort of terror, at its stupendous impressiveness.<sup>3</sup>

As a closing remark on the Segi ruins it might be added that in the long ago, as mentioned in another section of this article, the canyons were deeply cut. Then there was an aggrading of the canyon floors till the deposits often exceeded 50 feet in thickness, and this aggrading was still going on less than 40 years ago, the region being then a ponded, laked region. Now the streams have again cut to bedrock in the valley fillings. In the times of the villages there was undoubtedly plenty of water for irrigating purposes, and there is still. There was also a wide valley floor on which crops could be raised, and still can. There is enough land in the Segi canyons to support a population of 2,000 Hopi Indians, even as Hopis live to-day.<sup>4</sup>

#### *Kayenta Ruins.*

*Ruins at Black rock.* Black rock is a black volcanic rock point situated about three miles a little north of east of the Marsh Pass school. No ruins were built against the perpendicular walls of this rock, the walls exceeding 300 feet in height, the cliff people, no doubt, being afraid of falling rocks. But there are two sites of ruins in the vicinity, one in the flat to the west of it and one on the southeast slope of the south expanding part of the rock itself. Both of these villages were built of basaltic rock, plastered in with adobe mud.

3. See Fewkes, loc. cit., pp. 12-16. Also James, George Whorton; *Arizona the Wonderland*, pp. 58-60, for descriptions of this remarkable ruin.

4. For a more complete account of the ruins of the Segi canyons the reader is referred to Doctor Fewkes' work, cited above.

The ruin on the southeast slope of the rock was quite large, as the heaps of rocks now show. Some foundation walls are still in place, but the buildings are all leveled. Probably 150 people lived in the place at one time. The site is much frequented by arrowhead hunters, more arrowheads being found there than about any other village ruin in the region.

The ruin in the flat west of the rock, coming within fifty feet of it, is now also leveled by the action of time. Besides the main ruin there were several detached buildings. Part of a circular room shows in foundation, probably a kiva. A large mound also shows, which is evidently the remains of a *mal pais* (basaltic rock) erected building. This ruin covers a space 400 yards long by probably 100 yards wide, its longer dimensions being in a north-and-south direction, but does not show a compact form of village, as is the usual style of that far-off time. Probably 100 people lived in this village. Much broken pottery and many metates and manos have been found on the site; also the writer found in the kiva debris the finest specimen of an Indian axe he has yet seen.

*No. 10.* (Nos. 1 to 9 are the ruins at Tuba, formerly described.) This ruin is on what is known as Moqui rock, an irregularly shaped sandrock butte just north of Laguna (Kayenta) creek, just west of the dam and reservoir system of the United States reclamation system, three miles west of Kayenta post office and the Marsh Pass Indian school. On it are the remains of a considerable ruin that was built, at least in part, of stone. On top of the butte are the remains of stone walls; also a sinus in the rock face, sloping southwestward, exhibits the remains of a wall crossing it; and southeast of the butte, in the flat, there was once a large village. Though bare of everything but scattered rocks and occasional foundation-rock walls, the top of the butte is still covered with pottery shards, notwithstanding the ever sweep of the southwest winds, which have removed the last vestige of the mortar and adobe that contributed to the make-up of the walls of the village of this long-forgotten people. The area of the top of this rock available for building purposes is between one-eighth and one-fourth acres, and the plan of the village, now extant, shows that every bit of it was utilized. The site was superb. On the east and north the walls of the rock are seventy-five feet in vertical height and are almost perpendicular. The other face of the butte slopes southeast to the very water of Laguna creek and to the flats which then occupied the space where Laguna creek now runs. This made the rock easy of access from this side, but the village, from the lines of walls still in extant, shows that it was protected on this side by strong walls. For protection, therefore, the village was well located; also located handy to water and close to adjacent valley lands that were suitable for irrigation farming. When Laguna creek did not exist there were lakes in the vicinity, also the giant spring which now forms the hole in Laguna creek 500 yards below Moqui rock, now known as Kayenta (Tyende). From the size of the village on the rock and the site adjacent in the valley, between 500 and 1,000 people must have lived here at one time. In addition, the arrangement of the villages about this rock in the adjacent flats (see plate 4) indicate that it was the citadel or fort of the community, to which the villagers in the vicinity could rush when attacked by the more savage hordes. Within a radius

of three miles of this rock there are the remains of fifty-nine known villages. This bears out the conclusion that this rock, as a hub, was the central fort of this section.

*No. 11.* In the valley of Laguna creek about due north of the boarding school, in a little flat between the rock walls to the southward and the creek, there is quite an area covered with pottery shards and occasional ridges of what probably was once adobe walls or house foundation outlines. Some walls show in foundation. The village was large, and probably had 500 inhabitants. In appearance it looks like it might have been as large as the present village of Jemez, N. Mex. It occupied a good site, though exposed in the open. The people who lived there were not afraid of enemies or they would not have built such an exposed village, unless they fled to Moqui rock or village No. 21 when attacked. Up to thirty-five years ago Laguna creek did not exist, as we have seen, and had not for many ages; also it had not occupied its present valley north of Comb ridge north of Kayenta for a longer period, as the adobe fill is seventy-five feet thick throughout this region. In the long ago when this village flourished the valley was no doubt flat floored and streamless. At that time a lagoon was formed southwest of the village between it and the V-shaped walls of Comb ridge adjacent, the village probably helping itself as a dam in impounding the water. This ponded area also extended eastward south of the village for quite a distance, and is a collecting basin for water even in our own time. Farm land was also found in the flat valley adjacent.

*No. 12.* An ancient ruin once occupied the top of a promontory capping the sandrock ridge between the school and Laguna creek, though every particle of the village and its pottery has been removed by the contending elements. The evidence that the village once occupied the site is that pottery shards surround the point in the talus debris on all sides. Possibly the village extended to the base of the promontory also. There are no criteria to indicate the size of this village. The site is fairly well suited for protection from enemies.

*No. 13.* Pottery fragments of a small village were found in the open flat about one and one-fourth miles southwest of Porras dikes, about one-fourth mile north of Laguna creek. The pottery covers a circular area. Unless much of it has been removed by wind and water, it was a very small village, containing less than 100 souls. No trace of walls could be found, only the mound and the shards. It was wholly unprotected from an enemy. No doubt they farmed the adjacent flats. The writer found Navajos planting corn in the mouth of a dry wash near there this last year. Their water supply was furnished by springs in the adjacent Navajo sandstone bluffs about a half a mile distant to the northward. There is a fine dripping spring there now.

*No. 14.* This is a ruin on the top of a flat, rocky promontory one-half mile northeast of ruin 10 (Moqui rock). A gulch and Laguna creek separates the two ruins. No walls remain; only broken pottery marks the site. It was close to Laguna creek and also to the flats east of the rock-bound mesa on which it is situated. A rock promontory abutted the village at the north-west, on which there was probably a watchtower. The village was fairly well located for defense. Its size cannot now be determined.

*No. 15a.* This village topped a gentle ridge just west of the flat through which Three Mile wash runs, about a mile south of Moqui rock. The ruin is 300 yards long from east to west and of good width, though the original width could not be determined in the time the writer had to examine it, as it would require considerable digging to determine the limits of the village. Judging from the adobe heaps and the pottery fragments, the village must have surrounded a plaza with an opening to the east. Also, east of what one would naturally suppose to be the eastern limit of the village, judging from the earth piles, there appears to be the remains of a graveyard. The pottery found here seems to be less broken and never to have been used over a fire. The village seems to have been about as big as the present village of Jemez, N. Mex., and probably contained 400 inhabitants at its flourishing time. Situated on the slight rise above the common flat, it certainly was not located in such a site for defense. Otherwise it was admirably located. Three Mile wash in its lower, incised course did not exist thirty years ago. Up to that time the water of the wash gathered in what was termed a pool in the flat about east of the site of this ruin, and no doubt did the same in the long ago. This furnished both water for village use and for irrigating purposes. Something like 500 acres adjacent could then have been irrigated.

*No. 15b.* This ruin is about one-fourth mile east of north from ruin 15a. Its exact size and shape could not be determined, as it is partly covered with dune sand. Judging from its broken pottery, it was as large as ruin 15a. It was defenseless, but like its sister village, there was an abundance of water, also a large agricultural area adjacent to it.

*No. 15c.* (See plate 4 for plan of this village.) This village is situated on a rocky promontory about one-fourth mile northwest of ruin 15b and about due north of 15a. Its foundation walls were of rock. The main village was in rectangular form, 100 feet in length by 35 feet in width, extending in an east-and-west direction. It was divided into two sections, both extending in an east-and-west direction. The north section was 10 feet wide and was composed of rooms. The south section was 25 feet wide and seems to have been a plaza, probably surrounded by rooms. It is considerably lower in the center than on the margins. East of this main ruin, and probably forming a part of it, are the remains of a triangular set of ruins, in the center of which is a circular depression, which was most likely a kiva. The whole ruin covers the entire top of the promontory, and owes its shape to the contour of same. The promontory is 25 feet high and was evidently chosen for a village site for defense. Its village was probably the watchtower village for 15a and 15b and village 62, which will be described later. Its foundation was of stone, as indicated. The rest was evidently of adobe, which has been removed by the winds, as there is no stone left in the room space. The cross walls also seem to have been of adobe, as no trace of them is left. East of the rectangular structure is a rather large sink, which is probably the site of a kiva, as previously noted.

*No. 16.* Just around a point of a cliff across an arroyo one-half mile southwest of Porras dikes there is an arched-over cavern cliff from which a spring issues. Just east of the spring the huge Navajo sandstone cliff has broken off in giant blocks, which have simply fallen so as to remain as perpendicular monolithic blocks in front of the cliff's face. The place when these great

blocks still formed a part of the cliff would have made an excellent location for a cliff house or a cliff palace. We dug at the base of the fallen blocks to see if we could find any trace of such ruins. Our labors favored us, for we found ashes, charcoal, calcined rocks, and an Indian axe. Though this was not conclusive evidence that a cave ruin occupied the site, the writer is led to believe that such did, and that the caving off of the giant blocks likely drove the inhabitants from their secluded home. Certainly before the cleaving of the rock face it was an ideal place for a cliff house.

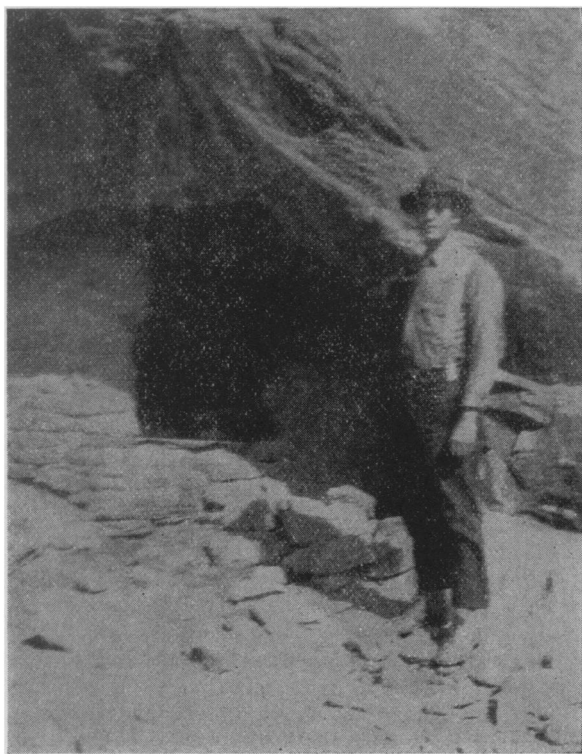
*No. 17.* Taking the road from Kayenta to Ship rock, past Church rock to within two miles of the eastern boundary of the Western Navajo reservation, one comes to a stone house by a spring which emerges from the north wall of the mesa that faces Tyende (Laguna) valley here. Also near the house to the southwestward there are two wells. The house has the honor of having been built and completed by a Navajo, the only house, so far as the writer can learn, that a Navajo ever built to completion for his own use in the Navajo country proper. It also has the honor of having its mistress buried in it. When the "flu" struck the place the lady of the house died just north of the rather pretentious fireplace, and the simple aborigines, being afraid of the dead, refused to touch her dead body, but instead they carried dirt and heaped it up over the body where she lay. They then broke the shovel and fled in such haste that they failed to shut the door to the house. Eleven days later, when the writer arrived on the scene, they begged him to shut the door, as "white man no fraid of chindes" (devils, or dead spirits). So he shut the door and fastened it for them. But as to the ruin the writer intended to describe: Near this springy place there was once a large village, only pottery shards now marking the spot. The writer also found a stone axe there. The place was well chosen. The springs furnished plenty of water, and to the northward adjacent there were rich farm lands, now too dry for farming for the most part, on account of Tyende creek having recut its channel so that the drainage now carries the water all out of the country. From the criteria at hand the size of this village and the probable number of its inhabitants could not be determined.

*No. 18a.* On the west side of a wagon road leading from the school to Black mesa, about a mile to the south of the school, indications of ruins supercovered with shifting adobe sand were observed. Fragments of much ancient pottery and indications of stone foundations are being exposed by wind action. About 400 yards further north along the same road pottery shards show in abundance; also what appears to be the rocks of foundation walls of a village are exposed for a considerable distance where the drifted sand has been shifted so as to leave the ancient adobe plain bare. There is not enough exposed in the two exposures to give any idea of the size or shape of this village, or whether or not it is the remains of two ancient villages; neither can the possible number of its inhabitants be conjectured. The site is wholly exposed so far as defense is concerned, but was admirably placed just west of a wide flat which was basined enough to hold water at its north terminus before the side streams of the valley cut out to the master stream and drained the flats. Old maps of this region show a pool at this place. The flats adjacent to this village still show the black loam which was accumulated during a not-far-distant ponded stage.

*No. 18b.* On the east side of the same road on which No. 18a is situated, and about one-fourth mile north of that ruin, are the remains of a ruin showing potsherds and some accumulated rocks, which probably mark foundations of buildings. It is situated on a slight rocky rise just west of the north terminus of the pocket flat on which No. 18a is situated, as mentioned. The terminal end of the flat shows evidence of even recent ponding. There also seems to be indications that a spring issued from the rock ledge on the margin of this pond in the long ago. The ruin site is covered with shifting earth at the west, so that its approximate size could not be ascertained. It was wholly defenseless so far as the site was concerned.

*No. 19.* In a little sand flat between two sandrock butte teeth of Comb ridge, about a mile northwest of Kayenta, considerable pottery was discovered in a fragmentary state, intermingled with shifting sand. It apparently was a small village site, probably the home of a single family. One piece of the pottery was yellowish, and was evidently made from material taken from a yellow bluff near by. So far as present water supply indicates, the site was poorly chosen.

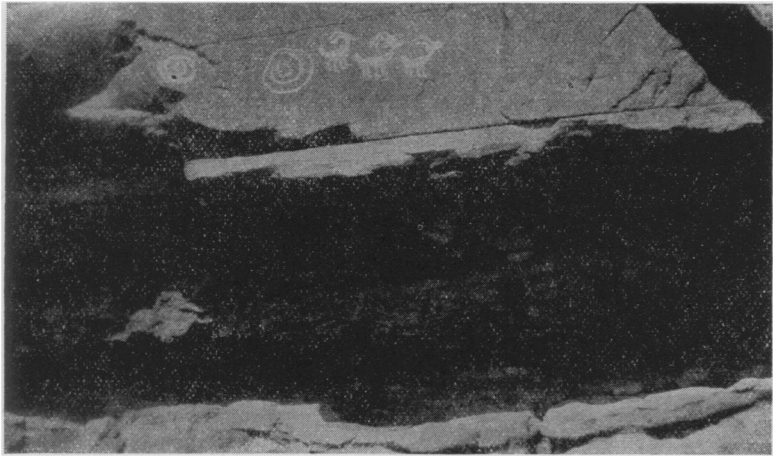
*No. 20.* This is a walled-up cave on the west side of a high butte of sandrock of Comb ridge, about a half mile northwest of Kayenta (Marsh Pass)



Cave, ruin 20.

boarding school. It is situated high up on the cliff's side and was well chosen for protection. A large water hole also exists between this butte and the next butte, 500 yards distant to the northwestward. Wood also is near at hand, as were the valley farm lands. The smoked walls show that it was used as a dwelling. A doll just like the kachina dolls used in the bean dance at Oraibi and Moenkopi was recently found in this cave. It was of wood, the size of a common doll, and painted. My helper, Mr. C. Taptuka, an Oraibi Indian, readily identified the doll and its use. This, as in other cases which will be mentioned later, seems to show that the Hopis occupied this region and these ruins are those left by that race; not by a Horn clan, or a Flute clan of that race, but by the Hopis in general.

Just south of this cave, at a slightly lower level on the same rock face, is the point remains of another cave, which has now been mostly removed by erosion. Its smoked walls attest its having been used by man.



Pictographs on the cliff above ruin 21.

*No. 21.* (On Man's Head Point.) This ruin is situated on a limestone shelf along the east face of a high cliff about one-fourth mile nearly due north of the Marsh Pass boarding school. The cliff is nearly perpendicular. Notwithstanding, part of the buildings at least were not built exactly against it. The cliff offered but little protection from the weather except the westerly storms, but it admirably protected the place from an enemy from the north and west, as it is unscalable and rises 300 feet above the village site. Moreover, the shelf on which the village is situated is 250 feet above the plain (valley of Laguna creek) to the northeastward. The ascent to it was made only over the long slope of the southwardly dipping limestone, where an enemy would certainly have met determined resistance as he was scaling the 25-degree sloping rocks. The place was evidently chosen for protection. The water supply was obtained from what is now Laguna creek valley, near by, most likely from the lagoon mentioned under ruin 11, which is in the flat not 400 yards distant. The lagoon there spreads out eastward



and southward from where the above-mentioned limerock meets the massive Navajo sandstone, where it dips beneath the level of the plain about 450 yards from ruin 11. The farm lands also were evidently those in the flat in the vicinity of village 11. It seems to be evident that the people who occupied those two villages were one and the same. They occupied the lower village in times of peace and the cliff village in troubled times. So far as No. 21 could be determined from surface appearances, eight rooms still remain in the ground plan; also part of another detached stone wall. (See plate 4 for plan of this village.) The walls of a circular kiva also show plainly. The size of the village, however, cannot now be determined, as all of it except that next to the stone wall of the cliff has been wholly removed by wind and water. The writer would judge that at least 100 people lived in this village, though the ruins, as now show, would probably not house more than 42.

The cliff has many pictographs pecked on it. On the wall against which the village was built are twenty-eight drawings of mountain sheep, two chindes (devils), one set of concentric circles, and one uncoiling circle. Back of the benched area, marked 6 and 7 on the plan of these ruins, there are also many more drawings—coiled lightning, mountain sheep, etc. Also, facing this rock on the northeast, at a lower level than the shelf on which ruin No. 21 is situated, are indications that a village was once placed there, but now wholly obliterated. Pieces of broken pottery are found all the way down the long talus slope from the perpendicular face of the cliff to the valley below. The face also has pictographs of mountain sheep on it.

*No. 21½.* This is a small ruin nestled among the projecting rocks of Comb ridge, across the creek from Nos. 11 and 21. Some of the walls still show.

*Nos. 22a-f.* In a little nook on the opposite (south) side of Laguna creek from ruins Nos. 13 and 16, to the northwest of a high cliff, there are the remains of six ruins built out in the flat, now being covered with shifting sand. There were probably other villages there, which are now covered with sand or have been removed by the creek's cutting through the flat in recent years. There is now no indication that there was water in the vicinity of these villages in that long ago, Laguna creek being cut since 1881. There is not a spring or a seep near them now. About a mile to the northward, however, there are now live springs, and there are indications that they were more extensive in the long ago than now. Moreover, as there was no drainage for the valley then, the creek channel being of recent date, as we have seen, the drainage of quite a country to the northward must have settled in pools and served as a permanent water supply and also used for irrigation. At that time ruins Nos. 13 and 16 were not separated from these ruins by the sixty-foot-deep Laguna canyon as now. These villages seem to have been placed in these locations northeast of the above-mentioned cliff simply to be out of the wind. They seem, furthermore, to be wholly unprotected from attacks except in their horseshoe structure and thick walls. There were surely but few enemies in the region when they were built or they would not have been built in the open as they were and of the dimensions and size some of them appear to have been. Below is a description of each in detail.

*No. 22a.* This village is straight in line with Chistla butte and El Capitan, near the sandstone cliff south of Laguna creek, and between it and the creek. It is built along a north-and-south axis. Thirty paces of the west wall show in part. It was built of stone, both lime and sand rock being used. The width of the village was apparently seventeen paces. (See plate 4 for plan of this village so far as now shows.) The village is now covered with shifting sand. There is much broken pottery; also two sandstone slabs used as arrow straighteners were seen. The village probably contained 100 souls. Indications seem to show that it was not long occupied, as the potsherds are sparse compared with what surrounds many other ruins.

*No. 22b.* This village is about one-half of a quarter of a mile to the west of No. 22a. The remains are scant. A little wall shows. This and a few pieces of pottery mark the site. It apparently was the home of a single family.

*No. 22c.* Pottery pieces indicate that there was a village about one-fourth of a quarter of a mile northwest of 22b, which is here designated as above. There are no walls in sight. The ruin was near the jutting northeast corner of the east-and-west wall of the rock promontory where it turns in a short curve to the southeast to make the curve in its contour which incloses the area where the villages (22 a-f) in the main are located. The village seems to have been small.

*No. 22d.* About 500 yards northeast of No. 22a there is quite an accumulation of pottery on a little ridge. No walls show. This village, judging from the pottery fragments, was also small, probably having only about fifty inhabitants.

*No. 22e.* About 300 yards due east of 22d is an extensive village site, with much pottery and slab-building rock flanking the dune which has now blown over the site. This village appears to have been long inhabited, and probably contained between 100 and 200 people.

*No. 22f.* Around a point of the cliff about one-half mile east of No. 22e are signs of a village, rock flags, pottery, metates, etc., showing on the surface. Most of the ruin has been removed by the encroaching creek canyon.

NOTE.—Upon the south sloping face of the cliff southwest of No. 22a several metates were found, but no pottery. These probably represent a burial place where several women were buried. Also about one-half mile due south of No. 22f, in an extinct crater, several metates and a few fragments of pottery were found. This also probably represents a grave. One of the metates was made of "crenulated" dolomite limestone, and resembles some ancient fresco in "scalloped" figures. It was worn entirely through and had one side gone.

*No. 23.* About four miles north of the Bradley store (Chilchinbito, or Bitter Weed Water), on the western route from Chilchinbito to Kayenta, a ruin was seen on the south front of a rocky bench which faced an east-and-west draw. We were on our way home from burying Mr. Bradley, who had been found dead in his cabin at the store, so had no chance to examine the ruin. Mr. John Wetheril, who was with the party, advised the writer that the nearest water to the site was about a mile distant to the westward. "Just a nice distance," he remarked, "for the Indian women to carry the water." The village was large, judging from the abundance of the pottery fragments. There were also fragments of grinding stones in sight in a greater quantity than is now usually seen about such dilapidated ruins. The ruin is very old, though some of the mound still exists. Built on the south front of the low bench, the site could not have

been chosen for defense. The farm lands of this village were evidently in the valley to the southwestward toward Black mesa; and unless there were other villages in the vicinity there was sufficient land for dry farming near at hand to amply supply the pueblo with food even now, as the villagers then lived. The Navajos have quite extensive fields for dry farming in the vicinity now, where they raise considerable corn.

*No. 24.* (See plan on plate 4.) This village is about one-half mile southwest of the Marsh Pass school. It is situated on the very top of a low bench, built in a northeast-southwest direction, with the opening to the northeast. The west and southwest walls show very plainly in piles of rock debris. The rest of the walls are hardly discernible. A plaza is represented by a low depression between the walls. The site is not exposed to wash. The west and southwest walls facing the winds are built of rock; the other walls seem to have been built of adobe for the most part. The pottery is scarce and mostly of the black-and-white type and of geometrical designs; only one red-striped piece was obtained. As the village seems to have fallen in ruins and every part of it still remaining on the site, it would probably be a good site to excavate. From the appearance as it now shows, surrounded by shifting sand, it does not seem to have been long occupied; at least the scarcity of potsherds would so indicate. Its debris is about three feet deep. It is almost circular in shape, with a circumference of seventy-eight paces and a diameter of about twenty-eight paces. It probably contained 100 souls.

*No. 25.* This village is fifty-six paces due north of No. 24, on the west side of the same bench. It is apparently older than No. 24 and was occupied a much longer time, as fragments of pottery are scattered a considerable distance around it. The pottery is of the same make as of No. 24, and it would appear that the same people occupied the two villages, No. 25 likely being abandoned when No. 24 was built. The villages were of about the same size. No. 25 was apparently open to the southwest or south, judging from the pile of debris. The ring mound of the old rooms is about sixty paces in circumference. No walls show and no red pottery was found on or near the site.

This village, with No. 24, was built on a raised bench, as mentioned, which would have afforded them some protection. They opened toward each other, which, if they were occupied simultaneously and they were friendly with each other, would also have furnished some protection. To the southeast of these were extensive flats where corn could be raised, and in the years ago there was a pool in that vicinity that could have afforded water for irrigation. Besides, the washes from Black mesa then had no outlet as now, so that their accumulated waters could be used for irrigation. The pool has been drained by canyon cutting since the coming of the white man. They also could obtain water for the villages from the springs along the bluff at Kayenta and the Marsh Pass school, the same as is now used by the school and teachers. Also, all along the bluff from the vicinity of the stockman's residence to quite a distance east of the school there are seeps and springs from which those far-off people likely irrigated quite a considerable area of land in the valley flats now occupied by the city of Kayenta and the Indian school.

*No. 26a.* (See plan on plate 4.) This village is nearly half a mile nearly due south of village No. 24. It was of large dimensions. Its west and southwest outer walls were of stone. The other walls were probably of adobe. A plan of

the village can now be traced. It was in a somewhat parallelogram to rectangular in shape, with the north end apparently open, the village being built mainly on an almost north-and-south axis. The east limb of the wall was twelve paces in length, as now shows; the west wall fifty-four paces. The closed end of the village was extended outward somewhat toward a circle segment and is forty-six paces in length in outer wall. The east and west sides of this village cannot now be traced farther than stated above, but scattered potsherds indicate that the village extended quite a distance eastward and also northward, but was of adobe construction, which has crumbled and been blown away by the winds. It probably contained 100 inhabitants when at its zenith. It was built in the open flat and had no protection except its own walls. There was no water within half a mile of it for domestic use, the springs at Kayenta being the nearest. About a half mile to the southwestward there are signs that there was once a pool, a black loamy spot now covering the site. There was also the pool of water to the eastward, mentioned with villages Nos. 18a and 18b, and also the extensive flats, also mentioned with the descriptions of those villages, which they likely farmed. There was also lands to the westward between it and villages No. 15a, 15b and 15c, which were also probably farmed.

*No. 26b.* (See plan on plate 4.) This village is also in the flat about a quarter of a mile nearly due north of No. 26a. It is without any natural protection and probably used the same farm lands and fields as that village. This village was rectangular in shape with east face open. The west outer wall was of rock. There seems also to have been three large rooms constructed wholly of rock, each now making considerable of a mound. The mound marked X within the ruin about the middle line of the north wall (see plan) was probably a kiva. That the village had square corners is only conjectural. The rocks of this village and of No. 26a had to be carried about a half mile. This village was apparently more compactly built than 26a, and also had the three solid stone rooms mentioned. It probably never contained over 100 inhabitants and likely not half that number.

*No. 27.* Just back of the little ridge about a quarter of a mile southeast of the school is quite a collection of broken pottery exposed in a ravine, which probably marks the site of a small village, which is all but obliterated.

*No. 27½.* About due east of the school, about half of a quarter of a mile distant, on top of a little point in the flat, are considerable potsherds and other indications that quite a village once occupied the site. The little mound that shows is probably the remains of the village debris.

*No. 28.* About a mile southwest of ruin No. 26a, on a little elevated spot of land, there is quite a bit of pottery, also the outline of the west wall of a village, extending a distance of fourteen paces. This village was never extensive and was not inhabited for any length of time, judging from the scarcity of pottery fragments. Probably twenty-five people lived in it. Near it to the southwestward is a square of two and one-half feet to the side, inclosed in rocks set on end.

*No. 29.* This ruin is on the eastern point of a low mesa about one-half mile southwest of No. 28. Parts of the walls of two rooms on the eastern front of the mesa still are intact. They are of stone. The village, however,

was of adobe construction and was large. On account of the shifting sand, which has covered the debris from a depth of from one to five feet, its exact size cannot be ascertained. The pottery shows for a distance of 400 yards in a southwest-northeast direction and also in cross section more than 100 paces. The pottery, where the wind has blown the sand off, shows in large quantities and indicates that the village was large and that it was occupied for a long period of time. Judging from the size, if the whole area was occupied simultaneously at least 500 people must have inhabited it. Its east wall, which stood on the east brink of the mesa, was undoubtedly of stone, as the few remaining walls indicate; stone was also plentiful on this point in scattered form. The rest of the walls were of adobe. A peculiar thing in the outskirts of this village to the northward was noticed: Where the wind had whipped the sand away little isolated mounds of rock were exposed, about which there was much broken pottery. The writer takes it that these were graves of women and that the culinary ware of each lady was broken on her grave, as most of the rock fragments were of broken grinding stones and other kitchen ware, including a great amount of broken pottery. This village, like No. 28, and also like No. 30, which will be described later, was wholly unprotected so far as its location was concerned. As to the farm lands of the village, it undoubtedly used the flats to the eastward, the same as villages Nos. 24, 25, 26, 27 and 28. Their nearest water was either in the foot of Black mesa or at Kayenta, and possibly pools on the flats which are now dry. A stream bed (dry wash) comes out from the mesa about two miles distant to the southward, where now in wet weather the water spreads out over a large area and sinks. In the time of this village it is likely that the water of this wash was kept more confined by damming, and by it a supply of water was maintained. Several dry potholes are seen in the vicinity, which also likely contained water then. A peculiarly painted pottery was found at this village. The painted part was in slightly raised relief, and was also peculiar from any other the writer has seen. The characters used were different. The writer also found one piece of pottery of the corrugated type, that had a raised relief near the upper rim that was intended to represent the common snail of the country. Fragments of metates and manos were also common.

No. 30. This village is about one-half mile southeast of No. 29, on a slight elevation of land which is now overcapped with shifting sand. The delineations of the ruin could not be made out, but, judging from the scattered potsherds, it must have been several hundred paces in diameter. There is some stone on the site which was carried from the vicinity of No. 29, but the walls in general must have been of adobe. Judging from the pottery fragments, at least 100 people lived in this village and must have occupied it for a considerable number of years.

About 300 yards east of the ruin the writer found a grave, which seemed to be that of a woman, as it contained the fragments of a large storage jar, a pair of manos and a metate.

About one-quarter mile nearly north of this village, out in an adobe flat, a small mound of rock sixteen feet in length by six broad was observed, about which there was some broken pottery, also some scattered rock. The writer judged that this was either a grave or the remains of a single-roomed stone house. If a grave it must have been that of some dignitary.

*No. 30½.* This is a village out in the flat east of the arroyo west of which Nos. 29 and 30 are situated. It is also about a half a mile northeast of villages Nos. 61a, 61b and 61c. It was a small village, probably never containing more than twenty-five people. It was circular and was built of adobe. Its people depended on the water of the same arroyo as Nos. 29 and 30, using the same to irrigate the adjacent flats. The site is now a broken-pottery-covered mound.

*Nos. 31 to 34.* These villages are just to the west of Laguna creek, over the rocks of Comb ridge northwest of the school, and are all perched on a sand ridge. All were without defense of any kind except their own walls. A part of the walls at least were of stone, the stone being carried at least a quarter of a mile from the mesa walls to the westward. The villages are on the north side of the gorge, where the creek cuts through Comb ridge on its northern swing east of Moqui rock, the rock walls inclosing the narrow valley being high on either side. Why the villages should have been perched on this wind-swept, sandy ridge instead of on the neighboring adobe flats, which are protected from the wind, is a puzzle. At the time of their occupation the uncrossable sixty-foot-deep canyon of Laguna creek, which faces them on the east, and its side canyons did not then exist. It would seem that since their abandonment the stream flowed for a long time at a level much higher than now, the old bench flood plain being of adobe instead of sand. The farm lands of these people must have been in the vicinity of Kayenta and also in the flats where the present creek flows, also to the northwestward near ruin 35, which will be given later. At the present time there are no springs in the vicinity, and as the creek did not flow there then, it is quite a quandary where they got their water for village use. Probably they had dams in the flat east of the sand ridge to the mesa to the southward of the present creek channel, where water was impounded.

Below are notes on each respective village:

*No. 31.* This ruin, as now shows, was small. There are some pottery fragments and a few rocks. Nothing is now in place. From the ruin as can now be seen, it never contained more than twenty-five people. Near this ruin was found an altar. It was in rectangular shape, inclosed in stone slabs set endwise in the ground, and apparently had been formerly inclosed with a capping lid. In it were broken pottery, flint chips, and the like. It might have been a child's grave over which these things had been placed. No bones were found in it, which seems to indicate that it was an altar instead of a grave.

*No. 32.* This village is 401 yards north of No. 31. It is situated on a little eminence of sand (or probably time has removed the surrounding original surface of the region till the peak protected by the rock of the village is all that is left of the former plain). It was built partly of stone. The original foundation walls of some of the rooms, especially on the southwestern edge of the village, are still in place. The southwest room is now quite a rock mound. The remains, as now exposed, are 32 paces in a southwest-northeast line and sixty-one paces in a northwest-southeast direction, as shown by the pottery fragments and walls. There is much broken pottery; also an altar near it, like that described under No. 31. There also seems to have been a large stone building about 100 yards to the eastward of the village.

*No. 33.* Across a 50-foot-deep ravine, about 400 yards north of No. 32, are the remains of what was once a stone village, built on a sand point of land. The main mound here is now in a northeast-southwest direction, and, as it now remains, is only about two rods long. About two rods east of this mound is a foundation wall in a nearly east-and-west direction still in place. Either it was a smaller village than No. 32 or most of it has been removed by erosion. Probably no more than twenty-five people ever lived in it. The scantiness of pottery fragments also indicates that it was not occupied long. A large pestle was found here, one of the largest the writer has seen; but, unluckily, some unknowing Navajo had mutilated it by chipping.

*No. 34.* This village is about a half a mile a little east of north from No. 33. It was built partly of stone. It was found to be covered with a heavy blanket of sand, so that its size could not be determined.

*No. 35.* This is a cliff ruin along the east face of the mesa that closes in Laguna creek valley and canyon here. Here two layers of massive sandstone are separated by a shaly layer less than four feet in thickness. The wall runs nearly north and south and the upper series projects over a little. The ruins are on the upper surface of the lower sandrock and fill the space between it and the sandrock above, to the depth inward that the shaly stratum had weathered, which seldom exceeds ten feet. The village when in the height of its power was fifty-six paces long and one room space deep. At the present time two rooms are wholly intact. One has an eight-foot front, four feet high in front, and rear height three feet; depth into cliff about ten feet. This was a living room, as the smoked walls indicate. The other room is four feet by three feet by a depth into the mesa of three and one-half feet. It must have been a storeroom for religious things. Parts of the walls of two other rooms show. The "front yard" of these rooms was a stone ledge less than two and one-half feet wide, and at the time of the occupation it must have been ten feet to the ground beneath the ledge. The cliff is now much broken and sheep have been occupying the shelf. Near the south end of the village on the face of the cliff there are twelve crude drawings of a hand in red, the drawing of a crude figure of a man dancing with dangling fox skin in chiseled outline, also several other crude drawings of human beings with tails like a fox, also in red. A large boulder near by also shows sixteen places where tools were sharpened or straightened. No pottery of any kind, fragments or otherwise, could be found. This leads the writer to conclude that the village was hurriedly built and never occupied. It was probably built for defense, like the village of Mesa, Colo., west of Jemez, N. M., that was built by the Sia during the troubled times following the Pueblo revolt of 1680.

About a half mile south of No. 35, along the same rock face but in the valley adjacent, some fragments of pottery were observed; but as the sand blown over the top of the mesa from the west had the whole east front of the rocky cliff submerged here in a deep sand dune, it could not be determined whether a village had been there or not.

*No. 35½.* This is a ruin under a cliff, up a small canyon, over a point about a mile to the westward of No. 35. It is high upon a shelf under an overcapping hood of rock. It was quite an extensive village. It has suffered much by the ravages of time and is now in a very dilapidated state.

*Nos. 36 to 43.* On the west side of Laguna creek are villages Nos. 36 to 42, while No. 43 is on the east side. All these are in the narrow valley where the creek cuts through Comb ridge in its northern turn east of Moqui rock, on which ruin No. 10 is situated. Villages Nos. 31 to 34, and likely No. 35, previously described, are a continuation of this series, including also No. 10 on Moqui rock. The general remarks on Nos. 31 to 34 apply to these villages as well. The writer wishes also to add that none of these ruins are on the first bench of the creek. It might also be added that it is the writer's opinion that the whole series of villages were made by the same people during a long period of years.

These villages, on account of the narrowness of the valley gorge here, are all much nearer the rock walls which inclose the canyon than Nos. 31 to 34 were, some being almost against it. Yet but little or no stone was used in the construction. A few square-shaped stone shrines were found, which now



Cliff house, ruin 35.

contain no curios. The ruins are all very old, as are ruins Nos. 31 to 34. They were constructed of adobe, each inhabited for a more or less extended period of time, then abandoned. They were then completely demolished, so that no walls were left standing. Then, as indicated in several places, from five to ten feet of loess or sand was piled over them, as over the rest of the valley. Then came the renewed canyon cutting and the removing of the sand and loess from over the ruins. Where any quantity of stone was used in the construction the denudation has been checked; even the pottery fragments have more or less checked it, so that to-day the village site is a little point of land from which dry gullies slope every way. The first bench of the creek course of the present time was probably swampy in the days of the villages; the creek canyon of our day did not then exist. Below is a description of each village in detail.

*No. 35.* Five hundred yards northeast of Moqui rock, ruin No. 10, the remains of a ruin shows beneath the shifting sand on a sand point to the north



(west) of the creek. Its dimensions could not be determined. Pottery fragments, metates and broken manos are strewn over the site. One whole, large metate for seed grinding was seen. The scattered pottery extends over 100 yards on the top of a little loess knoll in a northeast-southwest direction. Then the west stone foundation of a room is exposed, extending seven paces in a north-south line. To the south of it are the remains of a smaller room. From this place the village also extends eastward and southward 100 yards more, a deep ravine now cutting the village in twain. The whole site is much dissected and there is every indication that the ruin is very ancient. But very little stone was used in the construction. Toward the southeast terminus another mortarlike grinding slab of large proportions is exposed, also a broken metate. The pottery also increases in broken fragments toward the southeast. West of the stone house mentioned the houses seem to have been isolated; and again, after crossing a little valley to the eastward, a very recent ravine, the village still extends more than 100 yards further. Toward the southeast part of the latter division a large, slightly worn metate was seen, also several fragments of metates and manos. The loess and sand points still standing extend often as high as five feet above the debris of the village, now being rapidly degraded. The dimension from southeast to northwest is 225 paces, and from east to west, including the extension east of the ravine mentioned, something like 400 paces. On account of the denudation of the knoll on which the village was located, no idea of its original size could be determined. If it was all inhabited at one time it must have had a population of over 500.

*No. 37.* This ruin is about one-eighth mile northeast of No. 36. It is a small ruin perched on an adobe point. A part of a large, coarse-grained metate and much broken pottery are exposed. Most of the village has undoubtedly been removed by erosion. No walls or foundations now show. About 400 yards northeast of it is a pool of water held in by a sand dune that has blown over an adjacent cliff to the westward.

*No. 38.* This ruin is about 100 yards east of No. 37. The two were probably continuous in the old times. No walls show. A large mortar of sandstone, eight inches high, eighteen inches across, with mortar orifice over a foot across and six inches deep, sits on top of the ground. The top of the knoll on which the village is situated and the slopes of same are strewn with great quantities of pottery fragments.

*No. 39.* About 400 yards east of No. 38 are much broken pottery, a very large broken metate, some stone, but no wall of any kind shows to indicate the size of the village. It must, however, have been small, as there is not pottery enough to indicate that it was very large.

*No. 40.* Nearly a mile northeast of No. 39 there is a village site of eighty paces in length in an east-and-west line. It is situated on a narrow ridge that is being gradually cut down on both sides. Much stone was used in the construction. A square shrine, 2 feet by 2 feet, incased in rocks placed on end, was observed at the northeast terminus. The original size of the village cannot now be estimated.

*No. 41.* About 300 yards east of No. 40 are the remains of what seems to have been a single stone structure with outlying rooms of adobe construction. It was a small affair and probably had but one family occupying it. It was never occupied long, as the fragmentary kitchen ware is scanty.

*No. 42.* This village is about 200 yards northeast of No. 41. It is on the south edge of a bluff, facing the first bench of the creek. It is now mostly washed away. The remains show it to have been 100 yards in a northeast-southwest direction. There is much broken pottery. No walls were seen.

*No. 43.* The remains of a small village were found near the mesa walls of Comb ridge on the south side of the creek, about due south of No. 42. No walls now exist, only broken pottery and broken grinding stones. It probably contained twenty-five people.

*No. 44.* Just south of the Kayenta - Marsh pass wagon road, about a mile and a half west of ruin 16, in the vicinity of Porras dikes, pottery fragments exposed beneath the shifting sand give indication that a very ancient village once occupied the site, but was wholly in ruins and its adobe walls carried away by wind and water before the sand overspread the region.

*No. 45.* About a mile southwest of No. 44, on top of a bench mesa, is a small ruin whose entrance was from the west. The circumference of its walls is 110 paces. Its northwest and southwest parts were of stone and now show as low mounds. Many pottery fragments are to be seen in the vicinity. The people of this village and of No. 44 had no living water within a mile of them, as there are no signs that water ever stood in the flats adjacent. Also, from indications, their farm lands were at least a mile from the sites. They were each wholly unprotected from attack so far as natural protection was concerned, though they were undoubtedly protected by village walls. Neither village contained over 100 souls, and probably not over 50.

*Nos. 46 to 51.* These villages might be termed the "Government Hay Meadow Ruins," as No. 51 extends to the east fence of the government hay farm between Kayenta and Chilchinbito. These ruins are all in an extensive flat between two high mesa extensions of Black mesa, which completely walls in the valley near No. 51. A line of isolated buttes, finally extending into the rock wall of Black mesa to the westward, separate this valley into two parts to the eastward. One the south side of this line of buttes is an elevated adobe bench, the banking of debris that runs off of Black mesa on that side. This bench flat must be a mile wide and extends many miles to the eastward. The deposit is dark in color and is good soil, but on account of the lack of rain it is wholly barren. Villages Nos. 47 to 50 are on the north face of this deposit bench. No. 51 is in the foothills just north of the western flats of these deposits, at which place they are covered with native grass. No. 46 is to the north of a little sand ridge in what was a continuation of the same flat before the coming of the sand, which has been deposited by wind action in the lee of a point of the mesa wall to the westward. North of the isolated buttes and villages Nos. 47 to 50 is a low, flatlike swale of several hundred yards in width and miles in length in an east-and-west direction, being walled in at the westward by high walls. This swale-flat is from six to ten feet lower than the bench on which villages Nos. 47 to 50 were built. It shows signs of once having been boggy and of once having contained springs, but the whole low area is now dry and covered with grass. An ancient dam can be traced about sixty paces east of No. 47, by which water was impounded here for village use and for irrigation; but there is no water there to impound now with the exception of that from the melting snow and occasional summer showers. A

properly constructed dam, however, would likely impound much water here now. One thing was noticeable the past year: It rained in this section and in the vicinity of the head of Three Mile wash more often than any other section in the region. The clouds, backing up against the 1,200-foot walls of Black mesa, would shower in these two places day after day. With water to irrigate with from this dam, and likely from other dams constructed in the region, which time would not permit the writer to find, the people of these villages had fine and extensive farm lands at their command. So far as defense was concerned, these people had none except what the walls of the village afforded. None of the sites afford any protection whatever. In fact, they were placed in the most exposed places in the vicinity. It would appear that they had no enemy to fear or they would not have built their villages in such exposed positions, especially when the valley was closed in with mesa walls and a line of high buttes intersects the valley flats, on any or all of which they would have been safer from attack than in the open valley; but not a butte or an adjacent mesa, one being not 400 yards from the villages, has even a piece of pottery on it. The abandonment of these villages was possibly due to the shortage of water, as, with the exception of No. 51, none of the villages now has a drop of water in miles of them. But as they had at least one dam to retain water, it is more likely that they were compelled to abandon the region on account of the coming of a numerous enemy. Below is a description of each village in detail.

*No. 46.* This village site is in a flat between a sand-dune ridge on the south and a mesa wall to the northward that also closes in the area to the westward. The ruin is very ancient, existing so long ago that the mound of the village debris is entirely flattened out to a level with the flat area in which it is situated, and the pottery, where there is no wash, is scattered in all directions many hundreds of yards. Considerable stone was scattered over the site, which indicates that stone was used in part in the construction. Fragments of kitchen ware were seen all about the site. The village was small. There are no signs of any water ever having been near it north of the sand dune, but south of it, as we have seen, is the site of the dam east of No. 47. It is the writer's opinion that at the time the village was inhabited the dune, which is now from ten to twenty feet high and several hundred yards in length, did not then exist and that this village obtained its water from the same draw as villages Nos. 47 to 50 did. The writer believes this village is much older than any of the other villages of the series.

*No. 47.* This ruin is on the north front of the adobe bench facing the swalelike area to the northward. It was built partly of stone and has much kitchen debris in broken pottery and grinding stones scattered about. It was a small village. Near it and a little to the east is the remains of the dam previously mentioned. It was built directly across the swale in approximately a north-and-south direction. The part still remaining is a conspicuous mound built partly of stone.

*No. 48.* This ruin is one-fourth mile west of No. 47. It is similarly built on the north front of the adobe bench, facing the above-mentioned swale, which shows signs of once having been boggy and swampy. The village was built in the form of a parallelogram, sixty-three paces in an east-and-west line and probably a width of half that in a north-and-south direction, with

several outlying rooms. It was widest at the east and was probably open at the northwest. Considerable stone was used in the construction, especially along the north wall. The east-and-west rooms seem to have been mostly of stone, judging from the piles of stone now existing. A whole metate, several broken ones and much fragmentary pottery were observed. It is not likely that as many as 100 people ever lived in this village at one time.

*No. 49.* Seventy paces west of No. 48, on the north edge of the same bench, is a village 105 paces in circumference. It was open to the northeast, with opening 20 paces wide. The main buildings were at the north and west. They were of stone, now represented by low mounds of rock. Much broken pottery was observed.

*No. 50.* About 500 yards west of No. 49 is much broken pottery, several metates and other fragments, but no walls were indicated. It would seem from the appearance of the remains that it is an ancient graveyard. It would necessitate much excavating to determine its status.

*No. 51.* This village is on a little knoll in the piñon cedar timber just east of the fence to the government hay lands, on the foothill slope, about 400 yards northward from the flat meadow lands and about the same distance south of the eastern projection of Black mesa. The ruin is circular, 28 feet by 28 feet in cross diameter, and is flat on top, on the top of which are clumps of greasewood. Some stone was used in the construction. No pottery is shown on the top of the ruin, but is scattered all around it. The village makes a conspicuous mound and is undisturbed.

*No. 52.* This ruin was shown me by our missionary, Mr. L. Segar. It is across the wash of Laguna creek northwest from the volcanic plug, Black rock, northeast of Kayenta. It was built against a cliff and was properly a cliff house, leading toward the cave type. It was not large, but evidently, from the rock markings, was at least two stories high. Pottery and rocks of which the wall was built are scattered about the site. The writer recovered the handle of one jug that was made of twisted strands of mud. Just above where the floor of the second story would come there are flaring holes in the rock face. These are an inch across at the base. There are also about forty round holes about the depth and size of a thimble. These probably represent the sockets of spinning sticks. There are many glyphs on the walls, among which are that of a mountain sheep, a hand, the sun, etc. The mesa walls at the base are much smoked.

*Nos. 53 to 60, and 60½.* These ruins lie in the flat northwest of Moqui rock (ruin No. 10). Nos. 53, 54 and 55 obtained their village water supply from the branch creek that here enters the flat from the foothills to the northward and now joins Laguna creek near and to the westward of Moqui rock. No. 60½ also obtained its water supply from the same source. No. 60 received its water from springs in the breaks in the Segi mesas adjacent to the northwestward. The remaining villages got their water from pools caused by sand dunes damming up the watercourses. Water for irrigating was probably obtained for a part of the villages from the branch creek mentioned. The others undoubtedly raised crops by dry farming and by the flooding of the flats by the flow of water down the southern slopes of the rocks to the northward during occasional showers in summer. A considerable area is now cropped by dry

farming and flooding in this vicinity by the Navajos with success. None of these ruins were placed in suitable places for defense, though all top sand-dune areas. Little or no stone was used in the construction. Below is a description of each village.

*No. 53.* This ruin is just north of the road on a little mound of dune sand northwest of Moqui rock, just before entering the north branch of Laguna creek from the east. The mound is now nearly washed away. Its slopes and top are covered with scattered broken pottery. No stone was used in the construction of this village. Its size could not now be estimated, but it evidently was a small village.

*No. 54.* This was a rather large village, about 400 yards southwest of No. 53, on the opposite side of the branch creek mentioned. It was built of adobe and was wholly in ruins, the walls being entirely leached away before it was covered over with sand-dune material. Its pottery is scattered far and wide, reaching to the walls of the creek. It probably contained 100 or more people. It seems to be very ancient.

*No. 55.* This village is about six rods west of No. 54, topping a sand dune. It is not so large as No. 54, but appears to be as ancient. It was built wholly of adobe.

*No. 56.* This was a small village about a half mile west of No. 55. Some stone was used in the construction.

*No. 57.* This village is considerably over a mile from the last. It topped a sand knoll, which has been nearly removed by the wind. The east wall of a part of the village, which was of stone, is still extant, but the rest of the village site has been obliterated, leaving the slopes of the ridge streams covered with village debris, potsherds, etc. The people of this village evidently farmed the same area and obtained their village water from the same pool as ruin No. 58, as will be given later. The village was small.

*No. 58.* This ruin is on the top of a mound of loess about a half mile a little south of west of No. 57. This loess dune had closed a little valley northeast of the village, where even to this day there is a pool of water. They also farmed the land adjacent to this pool to the northward, which is to-day the cornfields of the Navajos in the vicinity. The crops were likely raised by dry farming, as previously mentioned. Some stone was used in the construction of the village. The stone had to be carried quite a distance. The village was small. No walls now show.

*No. 59.* About three miles west of No. 58 are pottery fragments scattered over quite an area, but no village now shows. The site is the top of a sand dune that impounds water to the north of it.

*No. 60.* This village is one-fourth mile east from an inverted V point on Comb ridge, where this ridge breaks off from the Segi mesa about due west of Moqui rock. It was circular, the plaza or kiva now being a depression. It was open to the west. Its principal walls were on the east side of the depression, where there is quite a mound, around and over which considerable broken pottery is scattered. The village was small, its diameter hardly exceeding thirty paces. It is on a little knoll between two dry washes and faces a gap in the rock walls directly northwestward, from which there were springs in the old times. This village, at least its western part, has been

much disturbed. The remains of a Navajo sweat house now cover this portion.

*No. 60½.* This village lies to the west of the north branch of Laguna creek, that enters that creek just west of Moqui rock, as we have seen. It tops a bench just west of Yellow Head's hogan and corral. It was quite an extensive village, now represented principally by its numerous pieces of broken pottery.

*Nos. 61a, 61b, 61c.* These villages are all some distance northwest of a dry wash which comes down off of the mountain (Black mesa) past Crank's stone house and spreads out on the flat about a mile northeast of the lowest village. This date (April 30) the writer followed the wash to its head, and though it had just rained three days before (April 25-27) along the mesa where it heads, it had not a drop of water in it from its source to where it vanished in the alluvial fan on the flats north of the villages, after running a course of several miles. In its middle course to below the last village it has been deepening its channel recently; but if dammed now at any place along its course it would reservoir water only for a short period after each rain. Yet it must have been from this wash that the villages obtained their water for domestic use. It is a known fact, of course, that certain Pueblos carry water for miles to their villages now, the springs at Kayenta being nearer these villages than the water-supply places are to many villages of our own time. The stream flattens out now, but leaves no water pool. There are no springs within miles of the place. The fields were likely on the flats to the north and northeastward. The crops were likely raised by dry farming with the aid of the flood waters of this wash during occasional summer showers. None of the villages are located on a defensible site. In fact, the upper village was built down in the flat adjacent to the walls of the west inclosing bench, so near it that an enemy on the bench would have commanded the entire village. Below is a description of each.

*No. 61a.* This village, the lower of the group, is about due south of Kayenta and about 1½ miles south of Black mesa. It is situated on the north end of a sand knoll northwest of the above dry wash, from which it is about 400 yards distant. It appears to have been quite large and to have been very ancient, the oldest of the group. It was built of adobe and was wholly destroyed before the dune sand, which now covers it to a depth of from two to three feet, was blown over it. No walls or mound show, but broken pottery is scattered over a considerable area.

*No. 61b.* This is a ruin one-fourth mile southwest of No. 61a on the same ridge, and about the same distance from the wash. It appears to have been built of two sets of stone buildings, which lay east and west of each other, respectively, and are now represented by north-and-south low-lying mounds of rock on which there are Navajo altars. The rocks had to be transported quite a distance for the buildings. The distance from the east side of the east mound to the west side of the west mound is thirty-two paces. Adobe walls completed the village, which was in horseshoe shape. It was seventy-nine paces in circumference, with opening of ten paces toward the southeast. Much broken pottery covers the site. Southeast of the village about 100 yards the wind is whipping the sand off of much broken pottery, which the writer believes exposes their graveyard site.

*No. 61c.* This ruin, abutting the west mesa that closes in the little valley of the wash mentioned, is in the flat, about one-fourth mile southwest of Mr. Crank's stone house, and probably a mile southwest of ruin No. 61b. The west, horseshoe-shaped part of the village was of stone, the semicircular foundation of which still remains, twenty-eight paces in length. The eastern part was apparently of adobe and stone. It is now completely obliterated except for a slight mound. The village was apparently open to the southeast. Its diameter from east to west is forty-one paces.

*No. 62.* This ruin is 400 yards west of ruin No. 15c. The latter is on top of a butte, to the west of which are the remains of a low ridge. No. 62 is on this low ridge, which extends in a southwest-northeast direction to the southwest foot of the above butte. Most of the pottery shows on the east side of this ridge, probably marking a graveyard site. West of where the pottery is most exposed is a circular mound of a circular village 104 paces in circumference, with hollow plaza now showing. The walls were of stone and now stand four feet high. The village was open to the southeast. From the south limb of the east side a large stone addition projected southeastward, now a stone mound four feet high. This ruin is undisturbed, except that Navajos have erected an altar in the east suburb. There is much broken pottery of large pieces, also many manos and broken metates. From this circular ruin the ridge is strewn with pottery and house remains and parts of walls to the very foot of the butte on which No. 15c is situated. This shows that a village or villages once occupied the entire ridge. If it was a continuous village simultaneously inhabited, 500 people must have lived in it. It is the writer's opinion that the circular part was the last village erected. A line of high buttes leading southwestward from this village (see plate 4) shows no signs of having been occupied by village sites.

*Nos. 63 to 79.* (See "Ruins encircling Moqui rock point," plate 4.) These ruins are situated in the valley of Three Mile wash. None were protected except by their own walls. All likely farmed the land of the valley of this wash and also got their water supply for village use from it and from Laguna creek basin, though no creek then existed there. Kayenta springs (or Tyende springs), a quarter of a mile northeast of Moqui rock, no doubt existed then as now, coming to the surface of the flats then instead of in the bottom of Laguna canyon as at present. If they had fortified villages then for protection in case of attack they were villages Nos. 15c and 10, the one on butte 15c and the other on Moqui rock. At the time these villages flourished Three Mile wash spread its waters out over a wide flat in the rainy season. The flat was a half mile to a mile in width and several miles in length, as is attested by the debris it left, sand ridges, mud flats, rows of cobbles, etc. It had aggraded its flood plain from ten to forty feet. Now that it has an outlet through Laguna creek, it has cut a deep canyon all the way through its own deposits and is chiseling in the underlying rock. The abandonment of the region by the villagers was not due to this stream's drying up, as it still had no outlet when the white man first came to the region, and instead was dotted by pools along its course. These villages, except No. 63, were built on adobe flats, or the sand piles on which they were built have since been blown away with the dirt of the adobe walls. In the case of most of them not one stone is left on another, and even the village mound has been blown away, leaving the broken kitchen utensils to declare the spot.

*No. 63.* This ruin is on a low sand ridge about one-fourth mile north of ruin No. 25, on the bench to the southward. No stone was used in the construction. No walls can now be traced and no mound now marks the site, over which much broken pottery is scattered.

*No. 64.* This ruin is on the east side of Three Mile wash, about a half mile south of Moqui rock. It was a small village, now completely leveled. Much pottery is scattered about the site.

*No. 65.* On the road about 400 yards east of the crossing of Three Mile wash is a small village, twenty-seven paces by twelve paces, planned in a north-south direction. It was apparently one building. Some stone was used in the construction, and quite a mound covers the site.

*No. 66.* A village site 350 yards north of No. 65 shows the skeleton remains of an extensive village or villages. The debris covers more than half an acre and probably represents at least three villages. Some stone was probably used in the construction of the foundations, but now no walls or mounds remain, only profusely scattered debris, stone, potsherds, broken metates, manos, etc. If it was a continuous village the site would indicate that it must have contained 1,000 inhabitants.

*No. 67.* This site is about 200 yards north of No. 66. Much pottery is scattered over a large area. One part of it, covering an area fifteen by thirty feet, has an immense amount of it, as though it might have been a storage place for death urns, containing the ashes of the dead. So far, however, the writer has not heard that these people practiced cremation.

*No. 68.* This ruin is northwest of No. 67. It shows scattered pottery fragments and some rock, but no defined village site at the present time.

*No. 69.* The site of this ruin is north of No. 66. The scattered pottery covers a wide area. The remains of a stone wall fifteen paces long, running in a north-and-south direction, still remains as a low mound. Much broken pottery, metates, manos, and a whole, large mortar were seen on the site.

*No. 70.* This site is thirty-seven paces northeast of No. 69. The village extended in a north-and-south direction about eighty paces and was probably half this in width. Adobe mounds cover part of the site, the village evidently being built mostly of adobe. Navajos have built a sweat house, altar and hogan on the northwest part.

*No. 71.* This is a small ruin north of No. 70, of which it might have been a "suburb." No walls can now be traced.

*No. 72.* The site of this ruin is about 100 paces north of No. 71. The broken pottery covers an area fifty-nine paces in an east-and-west direction and about eighty paces in a north-and-south direction, with scattered remains of rooms still extending northward. Some stone was used in the construction. The outline of quite a bit of the west wall shows. Much pottery and broken metates mark the site. It seems to have been built in nearly rectangular form and have been open to the northeast.

*No. 73.* This ruin is sixty paces northeast of No. 72. It was a small village.

*No. 74.* Occupying the site of the top of a rock knob across the creek southeast of Moqui rock and about 300 paces north of No. 73 is a village ruin of considerable proportions. A depression at the west and also near the middle of the site probably mark ancient kivas.



No. 75. This site is about thirty paces east of No. 72, representing a small village.

No. 76. This village is southeast of No. 72. It is thirty-nine paces in a north-and-south direction, built in horseshoe shape, open to the north. Lines of rock show the sites of the walls. The scattered potsherds do not indicate that this village was long occupied, as they are scanty.

No. 77. About one-fourth mile east of No. 76 is a small ruin that seems to have been a "long house," twenty-four paces long by twenty-four feet wide. It was built of rock, which was carried over half a mile. Many pottery fragments mark the site. There is also evidence that adobe additions extended northward quite a distance.

No. 78. This is a small village between No. 77 and the next village to be described. Some stone was used in the construction.

No. 79. This village lies south of the wagon road from Three Mile wash to Kayenta, about one-fourth mile south of No. 77. It was small and circular in form and was built partly of rock. Much broken pottery marks the site.

No. 80. This village is about one-fourth mile east of Nos. 77 and 78. It was very small and was unprotectedly built in an adobe flat. Its construction was partly of stone. Its site is now wind swept. Its postherds are much scattered.

No. 81. This is the remains of a ruin about due south of Moqui rock. It is on a little knoll. Much broken pottery, metates, etc., mark the site.

No. 82. This represents what appears to be a series of ruins, running along a sand-adobe ridge from southeast of the east terminus of the present reclamation dam westward to the junction of Three Mile wash and Laguna creek, south of Moqui rock. The creek is undermining the ridge and carrying it away toward the west. No village walls appear and no definite village mound, but large quantities of village debris, potsherds, etc., are exposed in different segments of the area, each of which probably marks a small village site. The sand is blown off of the ridge all but at the eastern terminus. If it represents a continuous village it must have housed at least 500 people. As is the case with all the ruins in this vicinity, it apparently is very ancient.

Nos. 83 to 93. (See "Ruins encircling Moqui point," plate 4.) These are what remains of very ancient ruins west of Three Mile wash. Most of them are on adobe wind-swept knolls, and only metates, etc., remain to mark the spot. As noted, they are all very ancient, and probably were built when the area was a flat, level region covered with sand dunes, all of which have now been swept away by the wind and by the flowing water which now seeks the creek and wash which have been cut since the days of the villages. The villages protected their sites from denudation; hence now are mounds, separated by slopes and gullies. At the time of the villages Three Mile wash turned westward and was impounded in the area now known as "Crank's farm" and other low areas extending on westward. The sand-adobe ridge which impounded it has just recently been cut through by the stream.

No. 83. This ruin is on a small knoll just north of Crank's cornfield. It seems to have extended much to the westward from what can now be definitely determined. It was built partly of stone, and apparently, judging by the scanty pottery fragments, it was not long occupied.

*No. 84.* This is a small ruin a little to the north of No. 83. It was evidently built wholly of adobe, all of which has been blown away, leaving pottery fragments scattered over the site.

*No. 85.* This ruin is on the west side of Three Mile wash, near its junction with Laguna creek. All that is now left is broken pottery and scattered rocks.

*No. 86.* The site of this ruin is on the bank of Laguna creek, 500 yards north of No. 85. Much broken pottery marks the spot. The creek has likely removed considerable of the village site.

*No. 87.* This is a village site on a low rise of ground. It is about 400 yards southwest of No. 85. There is much pottery here, but it is all broken into very small bits, which seems to indicate that the village is very ancient. The area covered by the village cannot now be determined.

*No. 88.* A village 200 yards southwest of No. 87, on an adobe knoll, was observed. The scattered debris seems to indicate that it was a very large village. No general foundation walls now exist. Several Navajo fireplaces have been made on the site. One particular spot contains an immense amount of potsherd material, which probably marks a burial site or a crematory. The foundation walls of one narrow room, lying in a north-and-south direction, still remain. It was five paces long by two paces wide. It was probably a secret closet.

*No. 89.* Located 387 yards southwest of No. 88 is much scattered broken pottery and other debris, but it is the writer's opinion that it is the Navajos' work, as the pottery is unmarked.

*No. 90.* A part of the foundation walls of what appears to have been a large village still exist, about 50 yards southwest of No. 89. It is situated on a wind-swept adobe knoll. Broken metates and much broken pottery mark the site. Much of the ware is of the crinkled, corrugated type. There is also some red ware with black markings and white ware with similar black markings. Several broken metates were seen.

*No. 91.* This village site is about 400 yards southwest of No. 90. Much pottery, strips of foundation walls, grinding stones, etc., mark the spot. Part of a much-decayed skeleton shows.

*No. 92.* This is a ruin of a small village about 150 yards southwest of No. 91. It is situated on the south side of the same ridge. It has been much disturbed by Navajo encampments. The remains of one very large hogan shows on the site, whose circular foundation walls were partly of stone and sixteen feet across. Two stone "fireplaces" also show. Much red pottery shows.

*No. 93.* The sand is being blown off of what appears to be the remains of a very large village about 600 yards northwest of No. 93. It is on a sand point. What appears have been walls of some of the rooms now show, and were at base partly of rock. Quantities of broken pottery are scattered about. A single house seems to have been built 100 yards to the eastward on the same knoll.

*No. 94.* (See "Lion Head group of ruins," plate 4, for 94-98.) Northeast of Twin Rocks, about a mile northeast of Black rock, is a small ruin site covered with much pottery. The Indian guide found an Indian axe there.

*No. 95.* A ruin a little northeast of Twin Rocks was observed. It was built on a sand knoll, which is now mostly blown away. The top of the knoll is capped with a large stone edifice, which appeared to be different from any ruin the writer had previously seen. It was circular and consisted of a single room about sixteen feet or less in diameter, apparently built in a somewhat igloo style. Its east and north walls are still intact. Much pottery is scattered about this edifice. As the ruin is circular, the writer at first took it for a stone hogan which had probably been constructed on the ruins of an ancient village, the rock of which it was built being from the stone of which the ancient ruin had been constructed. An objection was that no similarly constructed hogan of a Navajo had so far been seen by the writer, and he has never read of a hogan so constructed. On examining it his Navajo guide stated that it was not a Navajo structure. Our missionary, Rev. L. Segar, who was with the party, also stated that he had never seen a hogan thus constructed. The shards which were scattered about, on the other hand, were distinctively of the Pueblo cliff-house type. The writer cannot help but come to the conclusion that if this structure belongs to the cliff-house dwellers it was built at a later period than the other ruins of the region.

Since the writer examined this ruin, in the spring of 1919, Kidder and Guernsey's report on "Archæological Explorations in Arizona" has been published.<sup>5</sup> In this report, page 54, they described similar ruins to the one described above, being in the same valley, about five miles to the eastward. Below is a copy of their findings:

"The ruins on the bench (opposite the mouth of Olla House, about eight miles below Kayenta) consists of thirty or more round or oval inclosures, scattered irregularly over the whole slope. The circles which vary from six to ten feet in diameter, are made of large slabs set on edge. Excavation showed that each house had a hard floor of packed adobe, seemingly without a regular fireplace. The wall slabs are sunk into the ground from five to eight inches below the floor. There do not seem to have been lateral doorways, the inclosure usually being unbroken. In some cases the rooms are partly sunk into the sidehill, making them semisubterranean. As there is practically no fallen building stone in or about them, we think it probable that their upper parts were of the same 'turtleback' adobe construction that was observed by us in similar round rooms with slab foundations at Fluteplayer House. (The bottoms of the walls are made of large, flat sandstone slabs set on edge in the earth, in the circular constructions in the vicinity of Fluteplayer House, and the building was carried up by means of adobe 'turtlebacks,' masses of clay averaging fifteen inches long, five inches wide and three and one-half inches thick, which were put on wet and pushed and flattened down over the series below. An occasional stone was introduced among the adobes. After the structure had dried and settled together the irregularities and cracks were filled and smoothed over with more clay, making a firm, enduring, good-looking wall.<sup>6</sup>) This view is further strengthened by the type of pottery found in the foot or so of sand, charcoal and ashes which covered the floor in each inclosure. It is exactly the same style—both black and white, and coarse black with broad, flat coils about the neck—as is found in Fluteplayer House. In the rooms themselves we found no Kayenta shards, and very few of them among the thousands of fragments that litter the surface of the bench."

Messrs. Kidder and Guernsey placed these ruins in what they designated as "slab-house culture" group, stating that the pottery found by them differs from the true Kayenta wares. They place the "slab houses" they examined

5. Loc. cit., pp. 54, 42, 43.

6. Loc. cit., p. 43.

as earlier than the true Kayenta ruins, as does Professor Cummings as to similar houses found near Segiotso (Segihotsosi). The structure examined by the writer seems to be younger in time than the true Kayenta structures; but before any definite opinion can be had, more of such ruins must be found and examined.

*No. 96.* This is Box-elder Cliff Cave, so named because the only box-elder trees in the region grow near it. This cliff cave is large and could have accommodated a large village, but the writer could find no evidence that one was ever there. It has been reported to the writer that Doctor Cummings found nothing in this cave when doing excavating work in that section years ago. The cave opens to the north on the north side of a large cliff, and it may be for this reason that it was never inhabited.

*No. 97.* This is the remains of a cliff house on the west side of the third bench of Lion Head rock. It was found by Missionary Leigh Segar and his interpreter, Charles. The rooms filled in an excavated shelf along a shaly layer between massive sandstone strata. It was once quite extensive, but now only a single room remains, and a part of its side wall is gone. This room has about a twelve-foot front. A very small doorway still has the wooden crosspiece support above it in place.

*No. 98.* The site of this ruin abuts Lion Head rock on the southeast. The village is now wholly obliterated but for the scattered potsherds, which are all broken into small bits, seeming to indicate that the village is very old. Our Indian guide found a fine pottery dish six inches in diameter and four inches deep. It was under a large boulder on the second bench of the rock point just above the village. The piece of pottery was entire. It had probably been placed there in some votive offering to their gods, probably containing some kind of pollen or sacred meal; and though hundreds of years have passed since the hand that placed it there was placed under the sand, it still sat intact and upright to our day. One curious thing connected with it is that this boulder, on a sloping shelf near the edge of the cliff, though as large as an ordinary room in a house, should have been unmoved in these hundreds of years. Should it have moved, it would have broken the priceless dish.

*Nos. 99a to 99h.* These, as thus marked on the map, are as follows (see plate 4):

*No. 99a.* Signs of a ruin in scattered pottery show south of Three Mile Wash butte, but no village site shows. The butte referred to stands out in the flat as a detached part of Black mesa, some four miles southwest of Kayenta. A dry wash, a tributary of Three Mile wash, cuts across its southern front, and it is probable that this wash has carried away the village from which the scattered pottery came.

*No. 99b.* Part of the remains of a ruin is exposed one-half mile northwest of Three Mile Wash butte. It is on the west edge of a bluff overlooking Three Mile wash from the east. The main building was of stone, extending in a north-and-south direction twenty-one paces by probably twenty paces in width, the building collapsing inward. From it pottery extends forty paces southeastward and covers considerable of the slope toward the wash. A stone-enclosed Navajo grave, covered over with brush, mounts the pile of

rock of which the village was composed. No walls show. Some one has dug into this mound on the west side. The depth of the debris is about three and one-half feet in the part excavated.

*No. 99c.* A rock mound twenty-one paces in a north-and-south direction by about fifteen paces in an east-and-west direction marks the site of a village on the west edge of the above bench, one-half mile north of No. 99b, on the same side of the wash. Some pottery fragments show, but not enough to indicate that it was long occupied. A small Navajo altar occupies a site on its western margin.

*No. 99d.* The partial outline of a small village shows 378 yards northwest of No. 99c, on the same side of the creek. A Navajo has made a small altar on the site. But little pottery shows. A line of bowlders thirty feet to the westward served as "reserved" seats at their town gatherings (?).

*No. 99e.* A rock-mound ruin of a small building, probably the remains of a tower, is situated on a knoll across the wash 400 yards west of No. 99c. Some potsherds show. The edifice seems to have been circular.

*No. 99f.* This is a ruin on the top of a butte on the same side of the wash as No. 99c, from which it is about one-fourth mile distant to the northward. The partial outline of a rock-walled room forty-six paces in circumference still shows, with a depressed center. It was probably a watchtower and kiva combined. But little pottery was seen.

*Nos. 99g and 99h.* (Nos. 99f and 99g on the map.) These are two ruins on a sand knoll east of a long, north-and-south running, low mesa east of Three Mile wash. No walls show at either site, but much pottery is being uncovered by the wind. No. 99g was a large village.

*No. 99i.* (No. 99h on the map.) This is a large ruin out in the flat about one-half mile east of No. 99g (on the map). The village was of adobe and is wholly obliterated. Much broken pottery marks the site.

#### *Ruins in the Vicinity of Chilchinbito.*

About two miles north of Bitter Weed Water (Chilchinbito) trading post, twenty-three miles southeast of Kayento, a little to the east of the west road leading to the former place from the latter, a little pocket canyon leads eastward into a high cliff. The canyon is almost boxed, but is open at the head. In the shale along the north wall of the canyon are seeps and springs which supply a considerable amount of water. In the canyon, just east of the springs, are two clumps of apricot (peach) trees of mysterious origin. The mesa to the south of the springs is being covered over with shifting sand. In exposed patches beneath this sand there are village debris and an occasional wall foundation. The remains of a fireplace, which was probably in a kiva, also show. Much broken pottery, metates and manos are scattered about.

About a half a mile from this village there are several high buttes of sandstone. The south butte of the group is now inaccessible, though it once could be scaled from the northeast, and by the use of a ladder it could now be scaled. Its walls are fifty feet high. Its top cover about one-twelfth of an acre. There is every evidence that it was converted into a watchtower site or fort in the old times, as pottery and broken bread-preparing implements are scattered all about it, also many stones foreign to the butte. The principal

debris is at the northeast terminus of the butte, where the trail once led to its top. From this one would conclude that the main building was near this margin. The other buttes in the vicinity also show signs of having been village sites. Besides that, the whole front east of the buttes and extending northward toward the springs, and practically to them, is sprinkled with potsherds and other village debris, now showing here and there as the wind shifts the dune sand.

To the westward of the buttes is a large flat into which Spring canyon leads. This flat is a mile wide in places. It heads in several flat, radiating valleys in Black mesa adjacent to the southwestward. It is now terribly cut by ravines, gullies and canyons. In this flat the remains of ancient irrigating ditches can be traced, especially one running in an east-and-west direction about one-fourth mile north of the buttes.

The evidence shows that a series of villages once occupied the upland adjacent to these buttes. The permanent water supply for the villages for house purposes was the springs. For protection, fortlike villages towered the buttes, the principal fort being on the southeast butte. At that time the adjacent flats to the west were not cut with gutters and canyons as now, the cutting being prevented by careful use and storage of water. The flats were carefully irrigated and produced fine crops. Now probably thirty acres are farmed by the Navajos. It then supported a population of at least 500 souls. The abandonment of these villages and the total destruction of the fine valley lands by erosion tell a sad tale.

#### *Conclusion.*

From the data at hand, either a very numerous people lived here contemporaneously or a few people lived here a very long time. From the work of the Wetherils, Cummings, and Kidder and Guernsey,<sup>7</sup> it seems that we have three cultures represented in this region—slab house, basket maker, and cliff dweller, given in the order of their respective ages, according to those authorities. According to the same authorities, the slab-house people built round lodges with stone slabs set in the ground edgewise for base of the structure, over which probable "turtleback" adobe-mud "brick" were placed to finish the structure, the roof probably being flattish-conical. The basket-maker people used no pottery, but only baskets. Their chief burial place was in the caves of Kinboko canyon southwest of ruin A. The third culture comprised the cliff dwellers in general, whose ruins dot the country in all directions and fill every nook and corner and crevice in the canyon walls. They also place stress on the pottery found in the first- and last-mentioned houses, the slab-house pottery being the coarser pottery. The ollas of this type of ruin are full and rather squatty in body, and in the corrugated ware the corrugations in many cases are flattened bands.

The writer has nothing to add to the above findings, except some remarks on the slab houses.<sup>8</sup> The ruin he examined seemed to be even as young as the latest cliff houses of the region, but he has not data enough at hand to verify such a conclusion. His Hopi (Oraibi) helper, Clarence Taptuka, also concludes that the circular buildings, designated as "slab houses," are tem-

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7. See Kidder and Guernsey; loc. cit., pp. 200-212.

8. It may be found that the basket-maker culture was the culture of a basket society of the cliff-house village people.

porary kivas. He states that he has seen several of them used by his people in his own time, at the time of special ceremonies out from the village. According to his statement, the foundation of these structures is usually of slabs set edgewise in a circle, reinforced with adobe, which is also used to make the walls the proper thickness. From the base the edifice is often completed with poles set on end, extending from the base to the proper height, over which a wickerwork is woven, the same being plastered over with adobe both within and without. At other times other hurried devices are used. The "turtle-back" walls of Kidder and Guernsey show that the structure was hurriedly built, as the "turtlebacks" had been dried only enough for handling before being placed on the walls, as they showed signs of inashing and pushing together on the walls while yet in the plastic state. This bears out Mr. Taptuka's belief that they were temporary structures. He also believes that the numerous individual circular slab-house ruins on the bench near Olla House, ruin 7, of Kidder and Guernsey, "represent the collecting together of a large assemblage of the cliff dwellers on this bench for some special occasion, and that for the occasion a temporary kiva was erected for each clan. He also accounts for the coarser pottery by the fact that only such pottery, the poorer kind in finish, was used for such purposes. On such occasions the better, most valuable pottery was left at home, as the stay was to be temporary and only such cooking utensils as were needed were taken to the place of encampment.

If Mr. Taptuka's conclusion is correct the slab-house structure may be found in any cliff-house stage of culture, and may be recent or remote in time. Later in this article the writer will have more to add concerning these so-called slab houses.

The writer desires to add that many of the smaller ruins of the region of the undisputed cliff-dwelling type may have been constructed somewhat in the manner in which the slab-houses were constructed, and this may account for the small amount of rock about such ruins. And again, many of the villages show that the west and southwest buildings, or walls, were of stone, while only scattered pottery (and possibly a low mound) represents the remainder of the edifice. It seems, therefore, that the eastward-lying buildings of each village were of adobe structure or built of lattice work plastered over with adobe, as are some of the existing rooms at both Keetseel and Betatakin.

As to the undisputed cliff-dweller ruins and pueblos (ruins of the Kayenta culture) of the region, the evidence goes to show that the culture began with the small-house village type, the same as the peoples of Pine river valley, Colorado, described in this paper, and the small-house people of north central New Mexico, as described in *El Palacio* by Mr. Douglas.<sup>9</sup> Upon their coming into the region, or their development into a pueblo type in the region, they began the cultivation of the land and the use of water by irrigation. As they more thickly populated the region, more water was used. As a consequence, every side stream, every canyon, every spring had its village or villages depending upon it. Every bit of water was used. The washes had reservoir dams and check dams constructed in them to impound the water at every available site, as the writer has shown, and as was found at Marsh pass

9. Douglas, William Boone; The land of the small-house people: *El Palacio* for April, 1917; and The shrines of the small-house people: *ibid.*, July, 1917, pp. 19-29.

both by the writer and by Kidder and Guernsey.<sup>1</sup> As a result of this intensive use of the water from the washes, no water reached the master stream, which in the Kayenta section was Chinle creek, ultimately the San Juan. As a result, the valleys were aggraded, as we have seen. As the valley fillings mounted higher the villages were changed or rebuilt on the former debris, as is shown in many cases by cross-sectioning. Some of the villages that were buried are now being exposed in the canyon cutting, and so on. In time the outleading channels toward the master stream became filled up with detritus from the washes, which the weakened currents managed to carry to it, and also with wind-blown earth particles. Outwash, dry alluvial fans were also formed where the washes "dried up" on the flats. As a result of this damming on a large scale by natural processes, there was produced a ponded pool to laked stage. Under these conditions the house builders prospered, as there was water in abundance for every use known to them. They increased in numbers till their villages and cliff places were more numerous in the area than are farmhouses in central Iowa. There are more than 200 known ruins in the area mapped, which probably does not represent more than one-fourth of the existing villages in that area. In the Laguna valley part, from Comb ridge to Black mesa and from Church rock to Marsh pass, there are 100 ruins now known, which probably does not represent half of the number, though the area described does not exceed fourteen miles in length by seven miles in width in the vicinity of Church rock, tapering to a point at the pass. Thus was the extent of the villages at the zenith, of Kayenta power.

Then there came a withdrawal to larger centers, followed by the building of larger villages. One of these centers was evidently Moqui rock. Another lesser center was ruin 15c and the ruins in its vicinity. Then they apparently withdrew to the vicinity of Marsh pass and the Segi canyons, where the culture seems to have culminated, not once, but probably at different times, the final culmination being reached in the great cliff houses of the Segi canyon region.

Concerning this culture Kidder and Guernsey say:<sup>2</sup>

"To summarize: We have abundant remains, in the form of cliff-dwellings and surface ruins, of a fairly homogeneous culture occupying the whole region. It is characterized by stone houses built aboveground, specialized ceremonial rooms or kivas, and high development of pottery. Corn, beans and squash were cultivated, cotton was grown, and the turkey was domesticated. The textile arts were well developed, particularly in loom weaving, twilled work (matting, baskets, cotton bags), and twined work (cord sandals). Very good coiled basketry was produced, but apparently in rather limited quantities. Stone implements, both polished and chipped, were not remarkable either for abundance or for excellent workmanship.

"All the cliff dwellings and pueblos examined were enough alike in architecture, kiva construction and pottery to warrant their being assigned to a single culture period. There are, however, differences between the pottery of some of the small settlements (ruins 2, 3, 4, 5 and 7), on the one hand, and a group consisting of small houses 6 and 8 and the pueblos of Marsh pass on the other, that seem to show a variation of some sort within the culture, and therefore point to a fairly extended period of occupancy. The wares of the former division lack in general features characteristic of high specialization (shapes such as the flat-topped ollas and colanders; intensively elaborated decorations, as 'underframework' in black and white; white-edged designs in polychrome)

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1. Loc. cit., pp. 64, 65.

2. Loc. cit., pp. 200, 201.



which are found so commonly in the wares of the second group. This would seem to indicate that the ruins of the first group were somewhat earlier than those of the second, and also that they were of somewhat wider distribution; also that toward the end of the period of occupancy of that district the population withdrew to the vicinity of Marsh pass, where the culmination of the culture, so to speak, was reached in the pueblos of the pass and the great cliff houses of its tributary Segi canyon."

In a footnote on the last page mentioned they further add:

"This process—*i. e.*, early diffusion in small sites, later concentration in large centers with high cultural specialization, and lastly more or less abrupt abandonment of the whole regions—is a common phenomenon in southwestern archæology. Examples are: Chaco canyon, Mesaverde, Lower Gila, Casas Grandes. It has not yet been satisfactorily explained, though an attempt to account for it on the basis of climatic change has been made by Huntington (1914)."

Doctor Fewkes believed that the ruins of this region were made by the ancestors of the Horn, Snake and Flute clans of the Hopis of to-day.<sup>3</sup> Kidder and Guernsey call it Kayenta culture and leave it at that. Following Doctor Fewkes, it is the writer's opinion that a great part of the ruins are of villages made by the ancestors of the present Hopis, except that he believes they were made by practically the whole Hopi tribe proper, and not by two or three of their clans. The ruins which seem to have been made by them are too extensive and too numerous to have been made by a few representative clans of that people.

Many glyphs on the rock walls are undoubtedly of Hopi maidens with their whorled hair, representing the pumpkin blossom of fertility.<sup>4</sup> My Hopi helper, Clarence Taptuka, and his wife's relatives also readily identify the glyphs on the rock walls near ruin 21 on Man's Head point to be the clan signs of the Snake, Spider and Rabbit clans of their people. A doll found in the cave northwest of the school (ruin 20) they readily identify as a kachina doll used in the bean dance ceremonies, also of their people. Ceremonial object No. 65 of Kidder and Guernsey<sup>5</sup> they identify as an ear pendant of their people, representing the spreading pumpkin blossom, used in the kachina dances and in the butterfly ceremonies. Also they readily identify the sun-flowers and cones found by Kidder and Guernsey and the bird figured by them as paraphernalia used by their people.

Mr. Taptuka states:

"The doll is used in the bean ceremonies at night, now had usually the night following Christmas. It is used in the initiation ceremony into the Bean Society, and is given to the novitiate the morning before the dance. The ceremony is secret. There are two degrees in this society. In the first degree the children wishing to join it are admitted into the kiva and are allowed to see the things of the gods that are collected for the ceremony. In the second degree there is a real initiation. On entering the kiva one is strapped by three people of ceremony. All three of the strappers are men, but one personates a woman and is so dressed. A Hopi is not considered a 'man' or a 'woman' till they have joined this society. The doll is used in the ceremonies of both degrees. After the ceremony the initiated used the dolls as play dolls."

3. Loc. cit., pp. 1-3, 24, 26, 34, 35.

4. See Kidder and Guernsey, loc. cit. pp. 90-94.

5. Loc. cit., p. 145.

He further states:

"The bird is used in the kachina dances. It is usually placed on some conspicuous place on the dancing mask. The cones are used to represent ears on the masks, also worn in certain kachina ceremonies (as Tacab [Tenebigii] is dressed on plate xxvi of the Twenty-first Annual Report of the Bureau of American Ethnology). Usually only one is worn on the mask, on the right side. False hair is then wrapped around this pretended ear and let fall over it in front so as to obscure it and the string attachments that hold it to the mask. This wearing of one ear on the mask is to illustrate a myth of the long ago, which states that a certain maiden, who was making her toilet, had one whorl of her hair done up to represent the pumpkin blossom, when she was attacked by an enemy, from which she escaped with her hair only half arranged.

"The sunflowers are used only in the bean dances. They are used somewhat like a forehead star is sometimes used by white people. They are used in the initiating ceremonies into the order. The wearer is a man impersonating a woman, and is so dressed. In the dance the women and men line up in the kiva facing each other, much like white people do in the Virginia Reel dance, the men occupying the right side of the room as one faces the banquet (visitors' place in the hall), the women the left. The men impersonating women line up with the women. In the dance the two at the foot of the rows (the ends farthest from the banquet) step to the center of the room and clasp hands (like Powamû and So Wühti are clasping hands as shown on plate xiv of the above ethnological report).<sup>6</sup> They then dance forward to the front of the room to the sipapu hole in the floor in front of the fire pit. They then retrograde in a backward dancing movement to the starting point. Then again they dance forward to the sipapu hole in the kiva, after which they separate, each going to his or her respective side. While this couple are thus dancing, the columns are dancing in a slight shuffle, side movement to the rear. As they thus dance the men wave rattles in their right hands and bunches of cedar twigs in the left, while the women wave longer cedar twigs in their left hands only. Also, as the respective partners come together for the central dance, the man gives his partner a 'hank' of corn bread baked in corn husks, so tied with yucca as to much resemble a white man's fancy necktie. This the lady accepts and thrusts into the bosom of her dress or within a fold of her blanket, provided she wears one. A 'set' lasts through the singing of a chanted song. Several sets are thus enacted. Then the participants repair to a neighboring kiva and enact the same ceremony again. Thus they go from kiva to kiva and perform till the close of the night. The collected corn bread, which has been tasted now and then, is then eaten without the kiva of each respective clan."

While there seems to be abundant evidence that a great part of the villages and cliff houses now in ruins were made by the ancestors of the present Hopis, there also appears to be evidence that other peoples lived in the region as well. There also seems to be evidence of a partial or whole abandonment of the region by the cliff-village dwellers, and either the return of the same with a modified culture or the repeopling of the region wholly by a new people of an allied Pueblo stock. Moreover, some of the ruins appear to be very recent.

Granting or barring the belief that the basket-maker and slab-house people were the first village people in the region, the undisputed first cliff people of the true Pueblo type were from the northeast, from the Montezuma creek, McElmo and Mesaverde country. With their coming they brought their culture with them. One of their characteristic things was the "six-pilastered" kiva, like those of the Mesaverde, McElmo and Montezuma creek type farther to the north. Turkey House, just around the corner of the rock ledge

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6. The parentheses are mine.

northeast of Keetseel, has such a kiva. The pottery of this ruin is also of an older type than that of its neighboring villages. Again, a great part of the kivas of the region are circular, which is not a Hopi type of kiva, theirs being rectangular with a simple front-place banquet. Moreover, the largest cliff villages, Keetseel and Betatakin, which it is believed are recent and were nearly if not actually contemporaneous, show directly opposite styles of kivas, as do many other ruins of the section. Betatakin has the rectangular kiva like the Hopis and the Jemez, and Keetseel the circular type like the San Felipe and Santa Anna Indians of New Mexico, some modified in detail.<sup>7</sup> It is evident that a different people occupied Keetseel from the people who lived at Betatakin, as much different from each other as the Jemez and San Felipe Indians of our day, the index of their dissimilarity in culture being shown in their kiva construction. Moreover, to leave the cliff ruins and go to the villages of the flats, some show evidence of extreme age. Some villages are deeply buried beneath shifting sands. Others, in practically similar positions with respect to weather and wash, still show signs of walls above the surface. Of other villages of similar protection, the pottery of one is found in large pieces, of another the mound of the village is completely obliterated and the pottery is all broken into small bits. Also, as we have seen, there are at least two styles of pottery—the pottery of the true Kayenta culture and that of the Turkey House type. The latter, with the six-pilastered kiva of that ruin, appear to be roughly contemporaneous with the Chaco canyon and Mesaverde periods; the former of a subsequent time.

Again there is evidence that certain ruins were built from material taken from other villages, which is evidence that the one set of villages superseded the others in time. As an example, ruins A and B have fragments from the ruin Tower House incorporated in their walls. Tower House, as we have seen, stands on a spur almost below ruin B. Only a small portion of the northwestern wall of this once considerable structure now remains. The double-faced, rubble-filled masonry was plastered within and smoothed without, as in ruin A. Some of the smooth-faced rocks with incised designs in the latter ruin seem to have been taken from this ruin, and undoubtedly blocks were taken from it and incorporated in ruin B. Concerning these incorporated incised rocks in this ruin Kidder and Guernsey say:<sup>8</sup>

"Built into the walls are several stones bearing incised designs (plate 19b, lower left-hand corner). That the decorations were cut on the stones before they were introduced into the masonry is shown by the fact that the adobe mortar runs over the designs in several instances. One block pictured in plate 20 is even more conclusive; it was broken in two and the halves were built into different courses of the wall."

The incised rocks were undoubtedly taken from the one ruin and built into the other. Moreover, the incorporating of the parts of the same slab into different parts of the wall show that the last builders had no idea of the designs depicted on the slab. Evidently the time elapsing between the building of the two villages was of long duration.

Concerning the stages of cliff and village building, most of the visitors to the region, including trained archæologists, are struck with the apparent re-

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7. See Kidder and Guernsey; loc. cit., p. 203.

8. Loc. cit., p. 58.

centness of some of the ruins, especially Keetseel and Betatakin. In appearance they seem to have been inhabited at no distant time. In fact, as one observer remarked to the writer, it seems, on looking on the magnificently preserved ruin of Keetseel, that the people who went on a feasting tour or left the village through fear yesterday should return to their adobe this evening. It is indeed a village of only yesterday. Yet notwithstanding the recentness in appearance of these villages, no civilized man, so far as can now be learned, has ever made mention of them till within a little over the last score of years. However, there seems to be evidence that well-preserved ruins were built within historic times.

Lieutenant Bell, Second United States Infantry, visited the region in 1869 and left his name on the walls of ruin A. A Spanish soldier (?), Ghos by name, visited Inscription House west of Betatakin and left his inscription thus: "Ghos, 1661 Ano." A Spanish sword was found in the northeast part of the Navajo country some years ago.

Professor Gregory mentions peach trees in the Navajo country, as follows: "Peach trees grow wild in Nazlini and de Chelly canyons, probably introduced by Spaniards."<sup>9</sup>

A peach grove also occurs at Chilchinbito springs and one in the Segi canyon region. Concerning the latter grove Doctor Fewkes says:<sup>1</sup>

"One of the most interesting discoveries in West canyon (west of Betatakin) is the grove of peach trees in the valley a short distance from the canyon wall. The existence of these trees indicates Spanish influence. Peach trees were introduced into the Hopi country and the Canyon de Chelly in historic times, either by Spanish priests or by refugees from the Rio Grande pueblos. They were observed in the Chelly canyon by Simpson in 1850."

Straw was also used in adobe in making brick in a ruin in West (Segi) canyon, which seems to show Spanish influence. The laying of the wall was hurriedly done.

Concerning these "brick" Doctor Fewkes says:<sup>2</sup>

"The ruins in West canyon (plate 2) are particularly interesting from the fact that the walls of some of the rooms are built of elongated cylinders of clay shaped like a Vienna loaf of bread (much like the 'turtlebacks' of Kidder and Guernsey).<sup>3</sup> These 'bricks' consist of a bundle of twigs enveloped in red clay, which forms a superficial covering, the 'brick' being flattened on two faces. These unusual adobes were laid like bricks, and so tenaciously were they held together by clay mortar that in one instance the corner of a room, on account of undermining, had fallen as a single mass. The use of straw-strengthened adobe blocks is unknown in the construction of other cliff houses, although the investigations at Cliff Palace in Mesaverde National Park revealed the use of cubical clay blocks not having a central core of twigs or sticks, and true adobes are found in the Chelly canyon and at Awatobi."

There seems also to be evidence that even the Navajos used the De Chelly cliff houses as places of defense since our occupation of the country. In one of the congressional publications (?) of about 1868 one of the generals who visited the region makes affidavit that the Navajos fired on his troops from cliff-house protections in the De Chelly region.<sup>4</sup>

9. Water Supply Paper 380, p. 73.

1. Loc. cit., p. 5.

2. Loc. cit., pp. 4, 5.

3. Loc. cit., pp. 42, 43. The parentheses are the writer's.

4. The book containing this affidavit was in the Wetheril library at Kayenta in the summer of 1919, and was read by the writer there. Diligent search for the book, however, now both by him and by the Wetherils has so far failed to locate it.

Indian traditions also indicate that at least a great majority of the recent-looking ruins were made by the Pueblos since the coming of the Spaniards.

When at Jemez the Indians told the writer that both in 1694 and 1696, when they were defeated by the Spanish allies under De Vargas, the bulk of their people fled to the Navajo country, where they remained many years. They also stated that many of their people remained with the Navajos, while some Navajos returned with them on their return to their former homes, and still remain with them. Moreover, in going around the village of Jemez one can readily determine those of the former Navajo stock from the true Pueblo type, thus verifying the tradition.

Mrs. Lulu Wetheril, who has studied the Navajo customs for many years and who is now chairman of the Woman's Roosevelt Memorial Association for Arizona and museum assistant of the State University at Tucson, Ariz., told the writer that there were several Jemez clans among the Navajos, also several clans from other pueblos, and that each clan had its tradition concerning its being incorporated in the Navajo tribe as a unit, with full, equal privileges with the original Navajos.

Concerning these accessions to the Navajo tribe the Navajo Ethnological Dictionary says:<sup>5</sup>

"Strangely enough, some of the . . . accessions, such as the Jemez, Sia and Ute clans, coincide both in name and affiliation with the original clans adopted by the Navajos from these tribes. These are not regarded as captive clans, . . . as their relationship with all the other clans of the group is never disputed."

Concerning the relationship of the Jemez with the Navajos, and the Jemez finally fleeing to the Navajo country, Doctor Hodge says:<sup>6</sup>

"In the opinion of Bandelier it is probable that ten pueblos were inhabited by the tribe (Jemez) in the early part of the sixteenth century. Doubtless the reason for the division of the tribe into so many lesser village communities, instead of aggregating in a single pueblo for defense against the persistent aggressiveness of the Navajos, according to Bandelier, was the fact that cultivable areas in the sandy valley of the Jemez and its lower tributaries are small and at somewhat considerable distances from one another; but another and perhaps even more significant reason was that the Navajos were apparently not troublesome to the Pueblos at the time of the Spanish conquest. On the establishment of Spanish missions in this section and the introduction of improved methods of utilizing the water for irrigation, however, the Jemez were induced to abandon their pueblos one by one, until about the year 1622 they became consolidated into the two settlements of Gyusiwa and probably Astialakwa, mainly through the efforts of Fra Martin de Arvide. These pueblos are supposed to have been the seats of the missions of San Diego and San Joseph, respectively, and both contained chapels, probably, from 1618. Astialakwa was permanently abandoned prior to the Pueblo revolt of 1680, but in the meantime another pueblo (probably Patoqua) seems to have been established, which became the mission of San Juan de los Jemez. About the middle of the seventeenth century the Jemez conspired with the Navajos against the Spaniards, but the outbreak plotted was repressed by the hanging of twenty-nine of the Jemez. A few years later the Jemez were again confederated with the Navajos and some Tigua against the Spaniards, but the contemplated rebellion was again quelled, the Navajos soon resuming their

5. An Ethnological Dictionary of the Navajo Language, by the San Franciscan Fathers of St. Michaels, Ariz., p. 426.

6. Hodge, Frederick Webb; Handbook of American Indians: Bull. 30, Bureau of Am. Ethnology, vol. 1, pp. 629, 630; Washington, 1911.

hostility toward the village dwellers. In the revolt of the Pueblos in August, 1680, the Jemez took a prominent part. They murdered the missionary at Gyusiwa (San Diego de Jemez), but the missionary at San Juan de los Jemez, with the *alcalde*, mayor and three soldiers, succeeded in escaping. In 1681, when Governor Otermin attempted to regain possession of New Mexico, the Jemez retreated to the mesas, but returned to their village on the evacuation of the region by the Spaniards. Here they probably remained until 1688, when Cruzate appeared, causing them to flee again to the heights. When Vargas came in 1692 the Jemez were found on the mesa in a large pueblo, but they were induced to descend and to promise the Spaniards their support. The Jemez, however, failed to keep their word, but waged war during 1693 and 1694 against their Keresan neighbors on account of their fidelity to the Spaniards. Vargas returned to Jemez in 1693, when they reiterated their false promises. In July, 1694, he again went to Jemez with 120 Spaniards and some Indian allies from Santa Ana and Sia. The mesa was stormed, and after a desperate engagement, in which eighty-four natives were killed, the pueblo was captured. In the month following, Vargas (after destroying this village, another on a mesa some distance below, and one built by their Santo Domingo allies three leagues north) returned to Santa Fe with 361 prisoners and a large quantity of stores. From this time on the only then existing pueblo of the Jemez reoccupied was San Diego, or Gyusiwa, which was inhabited until 1696, when the second revolt occurred, the Indians killing their missionary and again fleeing to the mesas, where they constructed temporary shelters. Here they were joined by some Navajos, Zuni and Acoma allies and made hostile demonstrations toward the Sia, Santa Ana and San Felipe people, but in June of the year mentioned they were repulsed by a small detachment of Spaniards from Bernalillo and Sia with a loss of thirty men, eight of whom were Acoma. The defeated Jemez this time fled to the Navajo country, where they remained several years, finally returning to their former home and constructing the present village, called by them Walatoa, 'Village of the Bear.'

Also concerning the same movements *El Palacio* states:<sup>7</sup>

"In 1646 the Spaniards hanged twenty-nine of the Jemez Indians for conspiracy with the Navajos. At the outbreak of the Pueblo rebellion of 1680 Jemez killed one of its two Franciscan missionaries, Fra Juan de Jesus. In 1694 the Pueblos of Jemez were defeated in a pitched battle by De Vargas, the Indians losing 84 killed and 361 prisoners, and their two towns were burned. In 1696 the Jemez people again rebelled and killed their missionary, Fra Francisco de Jesus Maria Casanes. They were defeated in San Diego canyon with a loss of 30 killed, including 8 Pueblo allies from Acoma. The Jemez fled to the Navajo country. By 1709 they had built the present pueblo."

Again, concerning the Navajo tribe's growth, Doctor Hodge says:<sup>8</sup>

"Some of the accessions were evidently of Athapascan origin, as is most of the tribe, but others were derived from different stocks, including Keresan, Shoshonean, Tañean, Yuman and Aryan; consequently, the Navajos are a very composite people. A notable accession was made to their numbers, probably in the sixteenth century, when the Thkchapaha-dinnay joined them. These were people of another linguistic stock—Hodge says 'doubtless Tañean'—for they wrought a change in the Navajo language. A later very numerous accession of several clans came from the Pacific coast; these were Athapascan. Some of the various clans joined the Navajos willingly, others are the descendants of captives."

The Tañean family included the Towa, Taño, Tigua, Jemez and the Piro group of Indians, and, according to the above by Hodge, it was accessions from this family that caused the change in the language of the Navajo from that of the pure Apache.

7. Mission churches in New Mexico: *El Palacio*, August 25, 1918, pp. 120, 121.

8. Loc. cit., vol. 2, p. 42.

That Pueblos have migrated to the country of the Hopi-Navajo is undoubted. Among these are the Hano of the Moqui. Hodge mentions these Indians and their coming to the Moqui (Hopi) country as follows:<sup>9</sup>

"Hano (contracted from Anopi, 'eastern people': Fewkes). The easternmost pueblo of Tusayan, northeast Arizona, and familiarly spoken of as one of the Hopi villages. It is, however, occupied by Tewa people, whose ancestors, early in the eighteenth century, migrated from the upper Rio Grande, in New Mexico, principally from an ancient pueblo known as Tsawarii, above the present town of Santa Cruz, where the hamlet of La Puebla now stands."

Also during the troubled times the Picuris and a part of the Taos fled to the Jicarilla Apaches at El Cuartelejo, in Beaver creek valley, Scott county, Kansas; the ruin of their village there being excavated by Williston and Martin in 1900. The site is 350 leagues (1,210 miles) northeast of Santa Fe.<sup>1</sup>

"The Sandias, near Bernalillo, N. Mex., abandoned their pueblo during the Pueblo revolt of 1680, most of the inhabitants fleeing for safety to the Hopi country in northeastern Arizona, where, probably with other refugees, they built the village of Payupki, on the Middle mesa, the walls of which are still partly standing. Payupki is the name by which the Sandia pueblo is still known to the Hopis. In 1681 Governor Otermin, during his attempt to reconquer New Mexico, burned Sandia. The people remained among the Hopis till 1742, when Fathers Delgado and Pino brought 441 of them and their children to the Rio Grande, but it would seem that some of these returned to Arizona, since Father Juan Miguel Menchero, in a petition to the governor in 1748, stated that for six years he had been engaged in missionary work among the Indians, and had 'converted and gained more than 350 souls from here to the Puerco river, which I have brought from the Moqui pueblos, bringing with me the cacique of these Moqui pueblos, for the purpose of establishing their pueblo at the place called Sandia.'"<sup>2</sup>

In Mr. Hodge's write-up on the Hopis<sup>3</sup> he gives more facts concerning migrations to the Hopi country. He says in part:

"The pueblos of Walpi, Mishongnovi, and Shongopovi, situated in the foothills, were probably abandoned about the time of the Pueblo rebellion, and new villages built on the adjacent mesas for the purpose of defense against the Spaniards, whose vengeance was needlessly feared. The reconquest of the New Mexican pueblos led many of their inhabitants to seek protection among the Hopi toward the close of the seventeenth century. Some of these built the pueblo of Payupki, on Middle mesa, but were taken back and settled at Sandia about the middle of the eighteenth century. About 1700, Hano was established on East mesa, near Walpi, by Tewa from near Abiquiu, N. Mex., who came on the invitation of the Walpians. . . . Two other pueblos—Sichomovi, on First mesa, built by the Asa clans (q.v.) from the Rio Grande; and Shipaulovi, founded by a colony from Shongopovi, on Second or Middle mesa—are both of comparatively modern origin, having been established about the middle of the eighteenth century, or about the time the Payupki people returned to their old home.

"The Honau (Bear) clan is represented on each mesa and is supposed to be the oldest in Tusayan. It is said to have come originally from the Rio Grande valley. . . . The Kohop (Wood) phratry came from Siskiyatki and have a

9. Loc. cit., vol. 1, p. 531.

1. See Hodge; loc. cit. p. 245, in account of the "Picuris."

2. Hodge; loc. cit., vol. 2, pp. 429, 430.

3. Loc. Cit., vol. 1, pp. 561-564.

few representatives in Walpi and in the other villages. The traditional home of the Kokop and allied clans was Jemez (q.v.), in New Mexico. . . . The Asa people were Tewa in kin, coming originally from the Rio Grande valley and settling successively at Zuñi and in Canyon de Chelly."

Again when taking up the archæology of the Hopi country, he says:

"Sikyati, another large and well known ruin, in the foothills of the East mesa, was occupied in prehistoric times by Kokop clans of Keresan people from the Rio Grande country. They had attained a highly artistic development, as exhibited by their pottery, which is probably the finest ware ever manufactured by Indians north of Mexico.

"Payupki, a picturesque ruin on Middle mesa, was settled by Tanoan people (apparently Tigua) about the year 1700 and abandoned about 1742, when the inhabitants were taken back to the Rio Grande and settled at Scandia.

"Some of the most important ruins in the Hopi country are situated on the rim of Antelope mesa, not far from Awatobi, and are the remains of Keresan pueblos. Among these are Kawaika and Chakpahu. In the same neighborhood are the ruins of Kokopi, once occupied by the Wood clan, originally from Jemez."

In writing about the Tanoan, he also states:<sup>4</sup>

"The (Tano) tribe was almost entirely broken up by the Pueblo revolts of 1680-'96, the Indians removing mainly to the Hopis of Arizona after 1694, and the last tribal remnant in New Mexico dying from smallpox early in the nineteenth century."

Also, in speaking of the clans of the Laguna Indians, he states:<sup>5</sup>

"According to Laguna traditions, the Bear, Eagle, Water, Turkey and Corn clans, together with some members of the Coyote clan, came originally from Acoma; the Badger, Parrot, Chaparralcock and Antelope clans, and some members of the Coyote clan, came from Zuñi; the Sun people originated probably in San Felipe; the Water Snake in Sia; the Rattlesnake probably in Oraibi; the Wolf and Turquoise in Sandia; the Earth clan in Jemez; the Mountain Lion and Oak people claim to have come from Mt. Taylor; the Lizard clan is of unknown origin. Laguna, therefore, is not only the most recent of the New Mexican pueblos, but its inhabitants are of mixed origin, being composed of at least four linguistic stocks—Keresan, Taínoan, Shoshonean, and Zuñian."

"The original settlers (of Walpi) were the Bear people, who are represented to have come from Jemez. These colonists were later joined by the Snake and Horn peoples, whose ancestors lived in extreme northern Arizona. The Kachina clan came from the east; the Reed people are descendants of women captured at a Hopi town, now a ruin, called Awatobi. The Kokop clan came from Jemez, and made Walpi their home after the fall of their own pueblo, Sikyatki, in prehistoric times. The Patki, Kuhuch, and Piba-Tabo originally came from the south, where ruins of their pueblos are still visible at Winslow and near Hardy, Ariz., on Little Colorado river. The Flute people came from northern Arizona, where they once lived with the Horn and Snake clans. The Asa migrated from Zuñi. The sociological history and growth of Walpi are as follows: (1) Formed by Bear clans; (2) increased by accession of Snake clans; (3) enlarged by clans after the overthrow of Sikyatki; (4) destruction of Awatobi and assimilation of many clans therefrom; (5) advent of clans from the Little Colorado; (6) advent of Asa clans from Zuñi; (7) advent of the Tewa clans, some of whose descendants now live in Hano."<sup>6</sup>

4. Loc. cit., vol. 2, p. 686.

5. Loc. cit., vol. 1, p. 752.

6. Hodge; loc. cit., vol. 2, p. 902.



Also concerning the movements of the San Cristobal, Doctor Hodge writes:<sup>7</sup>

"The natives of this pueblo (San Cristobal) and of San Lazaro were forced by hostilities of the Apaches, the eastern Keresan tribes and the Pecos to transfer their pueblos to the vicinity of San Juan, where the towns were built under the same names. . . . This removal (which was more strictly to a place called Pueblito, near the present Potrero, about two miles east of Santa Cruz on the Rio Santa Cruz) occurred after the Pueblo revolt of 1680 and prior to 1692, at which later date the natives were found by Vargas in their new locality. The pueblo was abandoned in 1694, but was later reoccupied, and was finally deserted in 1696 after the murder of their missionary in June of that year. Most of their descendants are now among the Hopi of Arizona."

It is also written concerning the ruined pueblo of Tsawarii: "According to Tigua informants, it was once occupied by some of their people who went to live with the Hopi."<sup>8</sup>

It is also stated that Tisama, of Laguna, near the Indian village of that name, was so named because, it is said, some Sia once lived there.

That the Asa clans of Hopi not only once lived on the Rio Grande, but built villages at Canyon de Chelly, is attested by Hodge, as follows:<sup>9</sup>

"In the early days this people (the Asa clans) lived near Abiquiu, in the Chama river region of New Mexico, at a village called Kaekibi, and stopped successively at the pueblos of Santo Domingo, Laguna, Acoma and Zufii before reaching Tusayan, some of their families remaining at each of these pueblos, except Acoma. At Zufii their descendants form the Aiyaho clan. On reaching Tusayan the Posiwu, Puchkohu and Pisha clans settled with the Hopi Badger clan at Awatobi, the remainder of the group continuing to and settling first at Coyote spring near the east side of Walpi mesa, under the gap, and afterwards on the mesa at the site of modern Hano. This village the Asa afterwards abandoned on account of drought and disease, and went to Canyon de Chelly, about seventy miles northeast of Walpi, in the territory of the Navajos, to which tribe many of their women were given, whose descendants constitute a numerous clan known among the Navajos, as Kinaani (High-standing House). Here the Asa lost their language, and here they planted peach trees in the lowlands; but a quarrel with the Navajos caused their return to Hano, at which pueblo the Tewa, from the Rio Grande, in the meantime had settled. This was probably between 1700 and 1710. The Asa were taken to Walpi and given a strip of ground on the east edge of the mesa, where they constructed their dwellings, but a number of them afterwards removed with the Lizard and Bear people to Sichumovi."

In verification of the above Doctor Hodge also gives the following in another section of the above-cited book (p. 306):

"A well-authenticated tradition exists among the Hopi that about the middle of the eighteenth century a group of their clans, the Asa people, deserted their village on account of an epidemic and removed to Canyon de Chelly, where they occupied the cliff shelters for a considerable period, intermarrying with the Navajos."

It is written of the dance fraternity known as Kachina:<sup>1</sup>

"Kachina: The sacred dancing phratry of the Hopi, comprising the Kachina, Gyazru (Paroquet), Angwusi (Raven), Sikyachi (Yellow Bird),

7. Loc. cit., vol. 2, p. 428.

8. See Tsawarii: Handbook of American Indians, vol. 2, p. 822.

9. Loc. cit., vol. 1, pp. 99, 100.

1. Hodge; loc. cit., vol. 1, p. 638.

Tawamama (Blackbird), Salabi (Spruce), and Suhubi (Cottonwood) clans. They claim to have come from the Rio Grande, but lived for some time near the now ruined pueblo of Sikyatki."

During the troubled times in 1697-1703 rebel Queres from Santo Domingo, Cieneguilla and Cochiti fled westward and built the pueblo of Cubero, fourteen miles north of Acoma.<sup>2</sup>

Concerning the ruin of Kokopki Hodge says:<sup>3</sup>

"Kokopki (Hopi: 'house of the Firewood people'). A large, ancient, ruined pueblo, attributed by the Hopi to the Firewood clan, originally a Jemez people; situated on a low mesa, near Maupin's store, at Mormon John's spring, in Jedith valley, two and one-half miles east of Kearn's Canyon school."

According to the above, this village was a Jemez pueblo.

Payupki was a pueblo, settled by Rio Grande Indians. Hodge says concerning it:<sup>4</sup>

"It is a ruined pueblo on a point of Middle mesa, six miles north of Mishongnovi, northeast Arizona. It was built and occupied by discontented Tanos, Tewa and Tigua from the Rio Grande, who left their homes between the Pueblo rebellion of 1680 and 1696. In 1706 the Payupki villagers were attacked and defeated by captain Holguin, who in turn was driven by the Hopi from their territory. In 1742 Padres Delgoda and Pino visited the Hopi country and returned to the Rio Grande with 441 Indians, said to have been Tigua, originally from Sandia and Alameda, and established them in the refounded pueblo of Sandia, to which village the Hopi still apply the name Payupki."

Most of these great movements were during the troubled times of 1680-1703, but there were other troubled times between the peoples of the region, and the Spaniards, almost if not as extensive as that of 1680.

When Coronado and his array of helmets and bright, shining armor came into the region of the village peoples there was a scattering of these simple folk, much like the fluttering efforts of a bunch of chickens to get away from a coyote who has suddenly got into the hennery. A summary of these troubled times in the Rio Grande region reads:<sup>5</sup>

"The Spaniards were received by them (the Tigua) with friendliness, but when it was decided to spend the winter of 1540-41 in Tiguex province (at Bernalillo on the Rio Grande), and the Spaniards demanded of the natives 'about 300 or more pieces of cloth' with which to clothe the army, even stripping the cloaks and blankets from their backs, the Indians avenged this and other outrages by running off the Spanish horse herd, of which they killed a large number, and fortifying themselves in one of their pueblos. This the Spaniards attacked, and after exchanging signs of peace the Indians put down their arms and were pardoned. Nevertheless, through some misunderstanding the Spaniards proceeded to burn at the stake 200 of the captives, of whom about half were shot down in an attempt to escape the torture to which the others were being subjected. Says Castañeda, the principal chronicler of the expedition: 'Not a man of them remained alive, unless it was some who remained hidden in the village and escaped that night to spread throughout the country the news that the strangers did not respect the peace they had made.' As a result of this ill treatment the Tigua abandoned all but

2. See Hodge; loc. cit., vol. 1, p. 369.

3. Loc. cit., vol. 1, p. 723.

4. Loc. cit., vol. 2, p. 218.

5. Handbook of American Indians, vol. 2, p. 748.

two of their villages, one of which was also known to the Spaniards as Tiguex, . . . , into which they took all their stores and equipped themselves for the inevitable siege. Every overture made by the Spaniards was received with derision by the natives, who informed them that they 'did not wish to trust themselves to people who had no regard for friendship or their own word which they had pledged.' One of the Tigua villages was surrounded and attacked by means of ladders, but time and again the Spaniards were beaten off, fifty being wounded in the first assault. During the siege, which lasted fifty days, the Indians lost 200 of their number and surrendered 100 women and children. Finally the water supply of the natives became exhausted, and in an attempt to leave the village at night and cross the river with the remainder of their women, 'there were few who escaped being killed or wounded.' The other pueblo suffered the same fate, but its inhabitants apparently did not withstand the siege so long. In attempting to escape the Spaniards pursued 'and killed large numbers of them.' The soldiers then plundered the town and captured about 100 women and children."

Castañeda continues by stating that the remaining Indians fled to the mountains and could not be induced to return till the army left the region for Pecos, and on the return of the army they fled again. The same is his statement of practically every place they went. The Zuñi fled to Thunder mountain. The Hopis fled at the coming of the men with the fiery-mouthed, four-legged beasts, as the Indians termed the horses—and so on. The statement says "the Rio Grande Indians fled to the mountains," but does not say where they fled; and, of course, there is no way of knowing whether the bulk of them ever returned, as it was forty years before another white man, Chamuscado, with eight soldiers, visited the region, and it was not till about 1629 that any real permanent settlement was made among them, at which time it was found that the earlier explorers had greatly "exaggerated" the population.

At several times between Coronado's time and 1680 there were troubled times, and each time the record reads: "The Indians fled to the mountains." As the Teya and the Apaches of the east were generally hostile to the Pueblos, and the Athapascans of the west were, on the whole, friendly in those early times, practically every time there was a disturbance the Pueblos fled westward and northwestward. The same was also probably true at least just prior to the advent of the white man. From the information obtained by Coronado, the Pueblo Indian enemies of that time were the Indians of the foothill-plains region. His expedition found the ruins of many villages between Bernalillo (Tiguex) and Pecos, also some villages where only a remnant were left as occupants. The Pecos advised him that these villages had just recently been overwhelmed by raids of the more savage tribes to the southeastward. At the time of these troubles in the Rio Grande-Pecos region the eastern Pueblos would flee westward for safety. Then when things would return to normal again all or a part of them would probably return.

Being Pueblos, they built pueblos in the places where they fled to in these trouble-upheavals. Sometimes the refugees from several different allied villages would together build the new village. Also at times even Pueblos of different linguistic families would join in building a common village. This, by the way, would lead to a change in the pottery design, etc., with a probable improvement of the same.

Thus did the Pueblos flee westward time after time and build villages, which they in time abandoned to return to their former homes. But all did

not return. Some remained with the Hopi, some with the Zuñi, some with the Acoma and Laguna, still retaining their Pueblo customs, modified in a measure by the customs of the peoples with whom they became amalgamated. Others became a part of the Navajo tribe, and though they were in such numbers that their incorporated words in the Navajo tongue have characteristically modified that language in a very noticeable degree, their identity, except a broken-down clan organization, has been wholly obliterated.

These comings and goings to the Navajo country and a staying of a part of those who came have resulted as follows: Both in protected places in the Navajo country and along the eastern margin of same are ruins of extensive villages which were constructed by these fleeing people from time to time, the more recent ones appearing as though they were abandoned only yesterday, so to speak. In addition, there are the remains of places of habitation and potsherds of the fragments of tribes that voluntarily remained with the Navajos and finally became amalgamated with that tribe. Moreover, their customs were deteriorating in their decline from the complex Pueblo type to that of the savage. In this change the pottery deteriorated in make from the specialized types of the village people to the very crude type of black ware of the Navajo. As a result pottery in all stages between the two would be expected to be found, and the same has been found in the so-called slab-house culture. And again, these incorporated peoples changed their places of dwelling from the pueblo type to the hogan, and one would expect to find lodges grading from the one toward the other, and this we do find in the slab-house structure. While still a house structure, the slab house was neither a pueblo nor a hogan, but a step between the two; and at that, possibly a hurriedly built, temporary abode—a foundation of rock, set on edge, was plastered over and built on with adobe (often plastered over a wickerwork frame) to complete the structure. The steps seem to be these: (1) A type pueblo; (2) a poorly constructed pueblo; (3) a hurriedly built structure, composed of "turtleback" brick; (4) the circular slab house; and (5) the hogan. Who can say but what the Navajo hogan is a combination of the Apache style of brush or flag structure and the Pueblo roundhouse (kiva) structure. (Also, in the development of the original Pueblo culture, provided it developed in the region, one would find the reverse—the development from the simple structure to the complex pueblo; and there seems to be evidence in places that such was also developed in the region.)

As these comings of the Pueblo peoples to the Navajo country and a portion of them remaining and becoming a volunteer part of the Navajo tribe seems to have occurred time after time, one would expect to find the gradation of culture from the village to the hogan repeated in varying form time after time; and such seems to be the case, though more data will be required to make sure of this point. It might be well to add here also that some of the refugee Pueblos might also have aligned themselves with the Piute and Utes and been absorbed by them. We might, therefore, find retrograde gradations between the true Pueblo and the Ute and Piute cultures.

The culture, as it is now understood, appears to have originated in the San Juan country, somewhere in the region where Utah, Colorado, New Mexico and Arizona meet, extending southward and eastward. At this time the villages were more or less of the small-house type, much like those of the Pecos people just prior to the coming of the Spaniards.

In writing of the Pecos Doctor Hodge mentions this phase of their habitation thus:<sup>6</sup>

"In prehistoric times the Pecos people occupied numerous pueblos containing from 200 to 300 rooms each, and many compactly built, single-story house groups of from ten to fifty rooms each. These were scattered along the valley from the north end of Canyon de Pecos grant to Anton Chico—a distance of forty miles."

In the same manner did the village people for a long period of time. Thus far and wide they pushed their possessions till they controlled a vast country. They were in undisputed possession and had no fear of enemies, else they would not have built their villages of the small-house type, and would not have built them in the open, exposed places as they did. Like ourselves, they felt secure. The ruins of that far-off time are now known as the villages of the small-house people, just as our own countrysides may be designated as houses of the single-house people by the archæologists 2,000 years hence. Conditions are such that we now feel secure in our one-family house; if they were not we would flock to centers for protection against a common foe. They felt secure in their small-house villages. Then there came troublous times. To meet the crises the villagers flocked to the cliffs or built those massive pueblo structures that are a wonder in our day, as did the Pecos just before the coming of the Spaniards. At this time the Pueblo culture seems to have reached its highest stage of perfection in the mesaverde region and in the Montezuma, McElmo and Segi canyons and in the regions about Canyon de Chelly and neighboring canyons. The six-pilastered kiva of Turkey House in Segi canyon shows that the culture came from the northeast to that canyon. Then the Pueblos were driven out of the region. The enemy—probably the Athapascans, Utes and Piutes—came from the west and northwest. Before them many of the Pueblos fled to the region of the Rio Grande-Pecos country. Others went southward. The Hopis tenaciously held fast to each inch of ground till they were compelled to leave it. They then retreated no further than they had to. At the coming of the Spaniards they were being driven out of Moenkopi by the northern savages. For 250 years in historic times they continued the struggle; and but for the aid of the white man, as is well known, the Navajo would have their beautiful fields under his ruthless heel there to-day, and the region where 300 Hopi now possess a fine village would be a desert.

Then after the Pueblos had all left the region of their ancestral home, like all peoples without records, this home passed into a myth. Moreover, the Grand canyon, that for ages, through the supposed will of their gods, was the barrier on the west and north between their lovely land of plenty and happiness and the wilderness of the savages on the other side, became the mythical "lagoon," the sipapu from which they believed they all originated and to which they expect to return at the close of this life. When we meet a stranger we often ask him, "Where did you come from?" The Indian is even more pointed with this question. To this question every Pueblo replied, "From the unfathomable hole in the earth" (the Grand canyon). Hence in passing into myth it became the hole (sipapu) through which the mythical first people came up from the mythical earth shelf below. To commemorate

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6. Loc. cit., vol. 2, p. 220.

this event and to keep it ever in mind, the sipapu hole—a small, round hole—is usually made in the floor near the center or near one end of each kiva, or in a slab of cottonwood similarly placed in the edifice, as a medium of communication with the underworld. The lagoon that they mention as sipapu, therefore, would appear to be the Grand canyon passed into myth. My Hopi helper, Clarence Taptuka, advises me that his people consider this canyon their sipapu. This would also point to a common origin of all the Pueblos, and also that their ancestral home was on the banks of that great chasm.

In the going and coming years after the great migrations, after a long lapse of time there arose troubles in the new homes and they were driven back or fled back through fear to their old homes, where the attitude of a former enemy had changed for a time. There they again made their homes till they were again driven out or became amalgamated with the more savage tribes of the region. Each time they returned they built a new set of villages. Two of the greatest of these westward migrations were probably in historic times—one at the time the Pueblos fled from the blazing armored men of Coronado, the other during the troubled times of 1680-1705. It is, moreover, quite possible that the recent-looking ruins, such as Keetseel and Betatakin in the Segi and a great part of the well-preserved ruins in De Chelly, Chaco and Del Muerto canyons, were built at this time.

In speaking of the ruins in Segi canyon Doctor Fewkes says:<sup>7</sup> "The writer does not regard these ruins of great antiquity; some of the evidence indicates they are of a later time." He continues: "Many of the ruins in Canyon de Chelly, situated east of Laguna creek, show marked evidence of being modern."

Concerning the modern appearance of certain ruins Hodge also says:<sup>8</sup> "That many of them (the cliff houses) were occupied in comparatively recent times is apparent from their excellent state of preservation."

The Jemez went to the Navajo country, so the Indian myths and Spanish records state. The records also state that at a later date the Spanish priests brought them back and they built their present village of Walatoo; but so far as the writer can learn, no record states to what part of the Navajo country they went. Betatakin has the appearance of a Jemez ruin and Keetseel that of a Santo Domingo village, and the kivas somewhat resemble those of these two respective villages, as now in use. That these two villages (Keetseel and Betatakin) are later in time than Turkey House near Keetseel is conceded by all the archæologists who have examined them. More data and a careful comparison of the pottery of these villages with the pottery of Gyusiwa at Jemez and the pottery of other eastern seventeenth-century villages of the Rio Grande region may throw some light on this subject.

The proof, beyond doubt, that a considerable part of the Tañean Pueblos, to which stock the Jemez belong, voluntarily joined the Navajo nation, as probably did a minor number of the other Pueblo stocks, may also throw some light on why the Pueblo population has so diminished in numbers and the Navajo made such a rapid increase. Lesser accessions, besides the numerous captives, may also have been added to the various Apache bands in the same manner.

Thus in historic times, according to the Spanish records, and in prehistoric times, according to Indian myths, the Athapascan family and also the Ute

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7. Loc. cit., p. 34.

8. Loc. cit., vol. 1, p. 309.

family of Indians were being increased in numbers at the expense of the Pueblos. Farther back in time, when the Pueblos were at the zenith of their power, the opposite was probably true. It was probably the incorporation of large bodies of people from other tribes in their different divisions that caused the three distinct Pueblo languages of our day, the same as the incorporating of a large Tañean stock with the Navajo has changed the latter's language, as all ethnologists recognize.

That the Pueblos left the region through compulsion or fear seems very clear to the writer, though he realizes that this is contrary to the accepted theory.

Kidder and Guernsey suggest that their leaving the region was possibly due to climatic change, stating:<sup>9</sup>

"It has not been fully explained, though an attempt to account for it on the basis of climatic change has been made by Huntington (1914)."

Doctor Fewkes sums up his opinion in these words:<sup>1</sup>

"The cliff dwellings were constructed partly for defense, but mainly for the shelter afforded by the overhanging cliff, and the cause of their desertion was not due so much to predatory enemies as failure of crops or the disappearance of the water supply."

But Hodge seems to be inclined to the other theory. In writing of the cliff dwellers he says:<sup>2</sup>

"It is commonly believed that the agricultural tribes of pre-Spanish times, who built large towns and developed an extensive irrigation system, resorted to the cliffs, not from choice, but because of the encroachments of warlike tribes, who were probably nonagricultural, having no well-established place of abode. This must be true to some extent, for no people, unless urged by dire necessity, would resort to fastnesses in remote canyon walls or to the margins of barren and almost inaccessible plateaus and there establish their dwellings at enormous cost of time and labor; and it is equally certain that a people once forced to these retreats would, when the stress was removed, descend to the lowlands to reestablish their houses where water was convenient and in the immediate vicinity of arable lands."

Again touching on this subject when discussing the Pueblos, he writes:<sup>3</sup>

"These are the cliff dwellings built and occupied by the ancestors of the present Pueblos, no doubt for purposes of defense against ancient enemies."

In the writer's opinion, there is no evidence that the cliff dwellers and Pueblos left this region on account of climatic change and the lack of water. On the contrary, from the coming of the cliff dwellers to this region to our own time the climate has remained practically the same. Had there have been any radical change, sufficient to drive even man from the region, it would show in the flora and fauna of the country. The remains of the plants and animals found in the ruins are the same as species now living in the region. If the country had become such a desert that man could not live in it, the plants and animals of the pre-desert time would have succumbed as well as man; but such is not the case. The hills, buttes and mesas are covered with the same

9. Loc. cit., 201n.

1. Loc. cit., p. 34.

2. Loc. cit., vol. 1, p. 306.

3. Loc. cit., vol. 2, p. 320.

plants now as in that far-off time; the same animals roamed the region then as when the white man came, and the same birds flitted through the air. Moreover, the geological and archæological evidence both show that through intensive irrigation produced by these people check dams were constructed in all the washes, and reservoirs were built at every possible place for the purpose of retarding the water flow and impounding it for village use and for the irrigation of their fields. The evidence also shows that through this careful use of the water the washes and master stream of the region became plugged with wind-blown earth and outwash material from the diminished, weak outflow of the mountain streams, due to the intensive impounding water system. As a result the valley floors were aggraded and pools of shallow lakes were formed along their courses. By this aggrading of the valley floors and the resultant ponded, laked stage, all the precipitation of the region was retained for the use of the cliff-dweller people; and this laked, ponded condition continued on down through the ages to our own time. But when the climatic conditions had reached the most favorable stage for the habitation of man, as there is ample evidence, the villagers left the region. Moreover, if they were compelled to leave the region on account of continued drought and lack of water, as is alleged, how could the Hopi, in a much drier section of the country, less than sixty miles distant, survive to our own time. It does not seem reasonable that the one could have survived to the number of 2,500 people and the other, in a more favored region as to climate and water supply, should have been wholly driven out by drouth. Another cause must be sought.

There is also ample evidence, it seems, that the Hopi were at least a part of the former people of this region, and it does not look reasonable that they would leave the beautiful valley of Laguna creek and the canyons of the Segi with their ponds and lakes for the sandblown region of the Hopi country of our day except through duress at the hands of a numerous enemy. Moreover, the concentration of the small-house peoples into huge communal edifices just before the abandonment of the region shows beyond doubt that they were harassed by such a people.

Again, the pueblos that have been abandoned in our own time have not been abandoned on account of climatic conditions, but through fear of attack, provided they were not overwhelmed by an enemy before they had a chance to escape.

The Quercho in the sixteenth century and the Comanche in the seventeenth and eighteenth centuries, in raids, so reduced the Pecos that the once populous village of 2,500 inhabitants was abandoned by its seventeen survivors in 1838, the remnant going the Jemez, where they now reside.<sup>4</sup> While on the way to Pecos from Tiguex (Bernalillo), in 1541, Coronado passed many villages that had recently been abandoned, and one or two others in which only a remnant was left, as we have seen. The Indians told him that a raid of the more savage tribes had decimated the inhabitants or caused them to flee to places of safety. The village of Honogee and other sites at Moenkopi were abandoned by the Hopi or Oraibi in historic times on account of the raids of the Navajos and Utes. Awatobi, on the Hopi mesas, was destroyed in 1700 by her jealous neighbors. The fourteen pueblos of the Piro along the Rio Grande in 1630 were reduced to four a half century later. "This was

4. Hodge; loc. cit., vol. 2, p. 221.



due not only to the efforts of the missionaries to gather their flock into larger pueblos, . . . but also to the danger to which the Indians were exposed from the Apaches of the 'Perrillo' and the 'Gila,' as the southern bands of that restless tribe were called."<sup>5</sup> Coronado found the country of the Taño (between Santa Fe and the Galisteo basin) almost depopulated on account of depredations of the Teya, a warlike tribe of the plains, sixteen years previously. He found Galisteo to be a small, strong village; the Pueblo de los Silos large, but almost abandoned; and another, farther eastward, abandoned and in ruins. Also between that time and Espejo's visit in 1583 they (the Taño) were compelled to abandon three more of their villages on account of raids of these same plains savages.<sup>6</sup> A short time after the destruction of the mission at Walpi in the revolt of 1680, impelled by fear of vengeance on the part of the Spaniards, as well as by the increasing attacks of the Apache, Navajo, and Ute, the village was removed to the top of the rocky mesa where it now stands.<sup>7</sup> "Chukubi was occupied by the Squash, Sand and other clans of the Hopi, who were afterwards joined by the Spider clan. Being harassed by enemies, among them the Ute and the Apache, it was abandoned, its inhabitants, joining those of old Mashongnoyi in building the present Mashongnoyi pueblo."<sup>8</sup> Also the whole group of Salina pueblos of the Piro east of the Rio Grande are known as the "Cities that died of fear," far in historic times, owing to Apache depredations.<sup>9</sup> And so on. For the same reasons and in the same manner were the villages and cliff dwellings of northeastern Arizona abandoned.

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### A List of the Cicadellidæ of Kansas.

P. B. LAWSON.

In the fall of 1919 the writer completed a paper on the leafhoppers of the state of Kansas. As stated in the introduction to that paper, only those species were included in the fauna of the state that were represented in the Snow collections or concerning the finding of which the writer had no doubt. At that time the Crevecoeur collection had not been studied, nor was the list of species in the collection of the Kansas State Agricultural College fully incorporated. In addition it was thought that records of other collectors would add to the number in the list.

Since that paper went to press the writer has had the privilege of examining the Crevecoeur collection, has obtained a full list of species in the collection of the Agricultural College, and has obtained the records of additional species taken in the state by Prof. Herbert Osborn. Species included from these sources are so indicated by the parentheses following the names. The following list, therefore, I think, will be an accurate record of all the leafhoppers hitherto taken in Kansas, for it includes species hitherto unrecorded, and eliminates others which though previously recorded were seemingly wrongly determined and hence should not have been placed on the Kansas list.

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5. Handbook of American Indians, vol. 2, p. 261.

6. Idem., p. 686.

7. Idem., p. 901.

8. Idem., vol. 1, p. 295.

9. Idem., vol. 1, p. 6, under the topic "Abo."